Workshop Manual

Fox 2004 ➤ , Fox 2010 ➤ , Fox 2014 ➤ ,
Gol 1995 ➤ , Gol 1999 ➤ , Gol 2006 ➤ ,
Gol 2009 ➤ , Gol 2013 ➤ , Gol 2017 ➤ ,
Gol 2019 ➤ , Golf 1999 ➤ , Golf 2007 ➤ ,
Golf 2016 ➤ , Golf BR 2018 ➤ ,
Kombi 1997 ➤ , Parati 1999 ➤ ,
Parati 2006 ➤ , Polo 2003 ➤ ,
Polo 2007 ➤ , Polo 2012 ➤ ,
Polo BR 2018 ➤ , Polo Sedan 2003 ➤ ,
Polo Sedan 2007 ➤ ,
Polo Sedan 2012 ➤ , Santana 1991 ➤ ,
Santana Quantum 1992 ➤ ,
Saveiro 2000 ➤ , Saveiro 2006 ➤ ,
Saveiro 2010 ➤ , Saveiro 2014 ➤ ,
Saveiro 2017 ➤ , SpaceFox 2006 ➤ ,
SpaceFox 2011 ➤ , T-Cross BR 2020 ➤ ,
Virtus BR 2018 ➤ , Voyage 2009 ➤ ,
Voyage 2013 ➤ , Voyage 2017 ➤
Voyage 2019 ➤ , up! 2014 ➤ ,
up! BR 2018 ➤

Air conditioning with refrigerant R134a

Edition 03.2019

List of Workshop Manual Repair Groups

Repair Group
00 - Technical data

Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

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00 – Technical data

1 General information on air conditioning

(VRL012848; Edition 03.2019)

The purpose of the manual is to supplement specific information on the use of R134a refrigerant gas in air conditioning systems, found in the repair manuals for each model.

Note

This manual may also be used as a study manual.

1.1 Basics of air conditioning

Caution

The non-authorized tools or material (such as contrast) may cause damage to the system.

Only the tools and material recommended by the manufacturer should be used, otherwise, besides damage to the system, the right to warranty may also be nullified.

1.1.1 Physical principles:

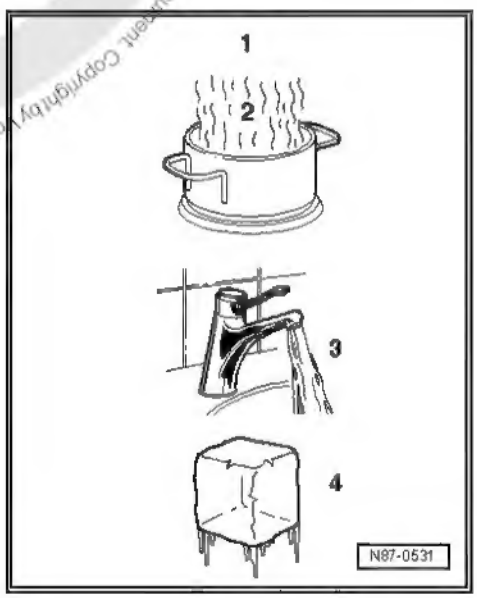
The four known states of water also apply to refrigerant gas in air conditioning systems.

1 - Gas

2 - Vapour

3 - Liquid

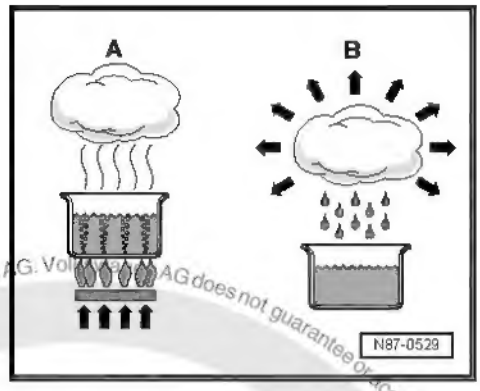
4 - Solid



If water is heated in a container (energy absorption), the steam produced is a vapour and if it continues to absorb thermal energy, it becomes gas. The process is reversible. If we subtract energy from water in a gaseous state, we obtain, in sequence, vapour, water and ice.

A - Energy absorption

B - Energy release



1.1.2 Heat is always transferred from a warmer material to a cooler one

All materials are made up of a mass of molecules in constant motion. The molecules with greater motion, of a warmer material, give up part of their energy to the molecules with less motion, in the material with lower heat load. Accordingly, the molecules in the warmer material slow down, whereas those in the cooler material start moving faster. This transfer repeats itself until the molecules in both materials move with the same speed. When they reach the same temperature, no further heat transfer occurs.

1.1.3 Pressure and boiling point

The boiling point of any liquid in the table of boiling points is always determined for an atmospheric pressure of 1 (one) bar. If the pressure applied on a liquid changes, its boiling point also changes.

We know, for example, that at lower pressures water boils at a proportionally lower temperature.

By analyzing the characteristic pressure curves of water vapour and R134a refrigerant gas, we find, for example, that vapour turns to liquid at constant pressure when the temperature decreases (in the condenser), and refrigerant gas in liquid state turns to gas when the pressure decreases (evaporator).

Characteristic water vapour pressure curve:

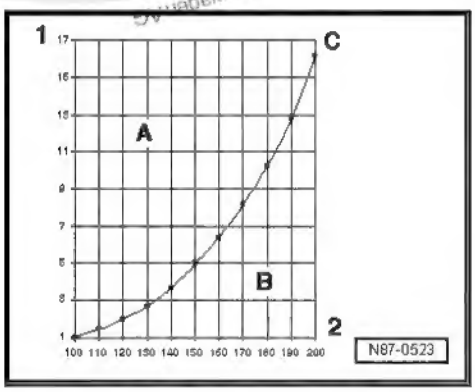
A - Liquid

B - Gaseous

C - Characteristic water vapour pressure curve

1 - Pressure applied on a liquid, in bar (absolute pressure)

2 - Temperature in °C



Characteristic vapour pressure curve of R134a refrigerant gas:

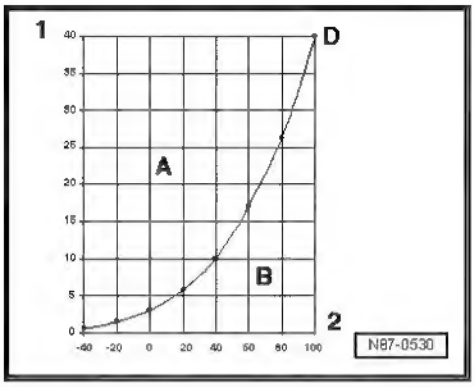
A - Liquid

B - Gaseous

D - Characteristic vapour pressure curve of R134a refrigerant gas

1 - Pressure applied on a liquid, in bar (absolute pressure)

2 - Temperature in °C



1.2 Vapour pressure table for R134a refrigerant gas

Technical literature on refrigeration systems contains a table showing vapour pressures for each refrigerant gas. This table makes it possible to determine the vapour pressure applied on the liquid column in the reservoir, when the temperature inside the reservoir is known.

As there is a specific vapour pressure table for each type of refrigerant gas, it is possible to determine which refrigerant gas is being used based on measurements of pressure and temperature.

Note

When pressure is expressed as absolute pressure, 0 (zero) bar corresponds to an absolute vacuum. Normal atmospheric pressure (overpressure) is equal to 1 (one) bar of absolute pressure. On most pressure gauge scales, 0 (zero) bar equals 1 (one) bar of absolute pressure (identifiable by the indication (–1) below the (0)).

Temperature in °C	Pressure in bar (overpressure) R134a
-45	-0.61
-40	-0.49
-35	-0.34
-30	-0.16
-25	0.06
-20	0.32
-15	0.63
-10	1.00
-5	1.43
0	1.92
5	2.49
10	3.13
15	3.90
20	4.70
25	5.63
30	6.70
35	7.83
40	9.10

Temperature in °C	Pressure in bar (overpressure) R134a
45	10.54
50	12.11
55	13.83
60	15.72
65	17.79
70	20.05
75	22.52
80	25.21
85	28.14
90	31.34

1.3 R134a refrigerant gas

The principle used in automobile air conditioning systems is that of evaporation and condensation. These systems use a gas with a low boiling point, known as a refrigerant gas.

The refrigerant gas used is tetrafluoroethane R134a, whose boiling point at a vapour pressure of one (1) bar is -26.5 °C.

1.3.1 Data on the physical properties of R134a refrigerant gas

Chemical formula	CH2F–CF3 or CF3–CH2F
Chemical name	Tetrafluoroethane
Boiling point at 1 bar.	26.5 °C
Solidification point	-101.6 °C
Critical temperature	100.6 °C
Critical pressure	40.56 bar (absolute pressure)

1.3.2 Critical point

The critical point (critical temperature and pressure) corresponds to the point above which there is no separating surface between the liquid state and the gaseous state.

Any material above its critical point is always in a gaseous state.

At temperatures below the critical points, all types of refrigerant gases contained in pressurized tanks have a liquid phase and a gaseous phase, that is, they have a gas layer above the liquid.

As long as both liquid and gas exist inside the tank, pressure will vary as a function of room temperature ⇒ page 3 .

Note

Refrigerant gases cannot be mixed together. Only the refrigerant gas recommended for each air conditioning system may be used.

1.3.3 Environmental aspects related to R134a refrigerant gas

- R134a is a fluorohydrocarbon (FHC), without chlorine.
- R134a has a shorter atmospheric life than the R12 refrigerant gas.

- R134a does not damage the ozone layer.
- The contribution of R134a to the greenhouse effect is 10 times less than that of R12 refrigerant gas.

1.4 Properties of R134a refrigerant gas

1.4.1 Trade name and designations

R134a is currently available under the following trade names:

- H-FKW 134a
- SUVA 134a
- KLEA 134a

Note

- *Designations may differ in other countries*
- *Although there is a great variety of refrigerants, this is the only one that may be used in vehicles. The names Frigen and Freon are trade names. They also apply to refrigerant gases that may not be used in vehicles.*

1.4.2 Colour

In its gaseous and liquid states, refrigerant gas is colourless, like water. This substance is invisible when gaseous. Only the interface between the gas and the liquid is visible. (level of liquid in the ascending tube of the filling cylinder or bubbles in the window). In the window, liquid R134a refrigerant gas may take on a milky colour. This cloudiness comes from the partially released refrigerant gas oil and does not mean there is any kind of problem.

1.4.3 Vapour pressure

The volume of refrigerant gas in vapour form contained in a closed container, not completely full, which evaporates at the surface, corresponds to the volume returning to liquid state through the clustering of the vapour particles. This equilibrium is achieved under pressure and is often called vapour pressure. Vapour pressure varies with the temperature ⇒ page 3 .

1.4.4 Physical characteristics of R134a

Characteristic curves of R134a and other refrigerant gases may be almost identical, so it is not possible to establish a clear distinction based on pressure alone.

In the case of R134a, the compressor is lubricated with a special synthetic oil for refrigeration devices, for example PAG oils (polyalkylene glycol oils)

1.4.5 Reaction with metals

When pure, R134a refrigerant gas is chemically stable and does not corrode iron or aluminium.

Impurities present in the refrigerant may contain, for example, chlorinated compounds which corrode certain metals and plastics.

1.4.6 Critical temperature / Critical pressure

R134a refrigerant gas remains chemically stable up to a pressure of 39.5 bar (equivalent to a temperature of 101 °C) Above this temperature, the refrigerant gas begins to decompose.

1.4.7 Water content

Water is only soluble in very tiny amounts when refrigerant gas is in its liquid state. In contrast, refrigerant gas vapour and water vapour can be mixed in any proportion.

Water present in the refrigerant circuit is dragged along in particle form (vapour). Agents present in the liquid container and/or in the collecting container have a maximum absorption capacity of about 7 grams of water. If there is still water in the refrigerant gas loop, it circulates to the expansion valve ejector or butterfly ejector (throttle), where it turns into ice.

The air conditioning then no longer cools.

Water damages the air conditioning system because high pressures and high temperatures together with any impurities cause acid to be formed.

1.4.8 Combustion

Refrigerant gas is not flammable. On the contrary, it has a fire-retardant and extinguishing effect. Refrigerant gas decomposes when it comes into contact with flames on incandescent surfaces such as UV lamps and soldering. This leads to the formation of toxic degradation products, which must not be inhaled. The first warning sign is irritation of the mucous membranes.

1.4.9 Filling factor

The tank must have a vapour chamber connected to the liquid chamber. As the temperature rises, the liquid expands. The space available in the vapour chamber decreases. At a certain point, the tank will contain only liquid. At this point, a small increase in temperature would be enough to create extremely high pressures in the tank, considering that the liquid continues expanding within its confined space. The resulting forces are strong enough to destroy the tank. To avoid overfilling the tank, the legislation regarding pressure determines the amount (in kilograms) of refrigerant gas that may be used, depending on the internal capacity of the tank, in litres. This filling factor, multiplied by the internal volume, gives the filling volume. In automobiles, the refrigerant gas volume to be used is 1.15 kg/l.

1.4.10 Leak detection

The refrigerant gas circuit may have leaks due to external damage, for example. In case small leaks are detected, due to the small quantity of refrigeration gas spilt in liquid form, an electronic leak detector may be used, for example. Electronic leak detection devices can detect annual refrigerant gas losses of less than 5 grams. (There are various devices of this type, specifically adapted to the composition of the respective refrigerant gases. For example, leak detection devices that are appropriate for R12 refrigerant gas do not work with R134a, as the latter does not contain the chlorine atoms which would be detected by the specific leak detection device) ⇒ page 65 .

1.5 Refrigeration system oil

The refrigeration system oil mixes with the refrigerant gas (between 20 and 40% depending on the type of compressor and on the amount of refrigerant gas), and is always present in the loop, lubricating the moving parts.

Air conditioning systems that use R134a operate with a special synthetic oil, for example, polyalkylene glycol oil (PAG). This is required because mineral oils, for example, do not mix with R134a Furthermore, materials used in air conditioning with R134a can be affected if the mix is subjected to high pressures and temperatures inside the refrigerant gas loop, or if the lubricant film is removed from the compressor. The use of unauthorized oils can damage the air conditioning, thus only duly certified oils should be used

The types of oils for R134a for use in automobiles can be found in the specific vehicle repair manual ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning or Parts catalogue⇒ Parts catalogue .

Note

- *Do not store refrigeration system oils in open containers; as these oils are hygroscopic (they attract water).*
- *Always store the oil in closed, airtight containers.*
- *Do not reuse oil. Due to its chemical properties, refrigeration system oil should not be discarded together with engine oil or transmission oil, and must be disposed of as oil of unknown origin. See manuals and procedures for disposal of chemical/ contaminated products, in compliance with current environmental regulations on refrigerant gas from air conditioning systems / refrigerant gas oils.*

1.5.1 Characteristics of refrigeration system oil

The most important characteristics are its great solubility with refrigerant gas, good lubricating qualities, being acid-free and having a very low water content. Accordingly, only certain types of oil should be used; list of authorized refrigerant oils and filling quantities⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .

PAG oils indicated for refrigerant gas R134a are very hygroscopic and cannot be mixed with other oils. Thus, any open containers should be closed immediately in order to protect the oil from humidity. The refrigerant gas oil undergoes an aging process in the presence of humidity and acids; it darkens, becomes viscous and becomes corrosive to metals.

Note

- *If the refrigerant gas loop uses R134a, the oil used must be certified for this purpose (Filling quantities ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning).*
- *Do not reuse oil. Due to its chemical properties, refrigeration system oil should not be discarded together with engine oil or transmission oil, and must be disposed of as oil of unknown origin. See manuals and procedures for disposal of chemical/ contaminated products, in compliance with current environmental regulations on refrigerant gas from air conditioning systems / refrigerant gas oils.*

1.6 Comfort

An essential prerequisite for alert and safe driving is the perception of comfort in the cabin This perception of comfort can be improved using air conditioning, especially if external temperatures and humidity are high. Although opening the windows or the sunroof and increasing ventilation obviously contribute to creating

a perception of comfort, they also bring certain disadvantages inside the cabin, such as higher noise levels, air currents, exhaust gases, non filtered dust and pollen (an inconvenience for those who suffer from allergies).

A well-regulated air conditioning system, together with a well designed heating and ventilation system, can effectively create a perception of comfort and well-being in the cabin by regulating internal temperature, humidity and airflow, in accordance with the prevailing external conditions. This applies to both stationary vehicles as well as those in motion.

Other important advantages of air conditioning:

- The air entering the passenger's compartment is purified (the humid slats in the evaporator retain the dust and pollen particles, which are then eliminated by the water from the condenser).
- Temperatures recorded inside a medium-size vehicle (e.g. after a short trajectory, with ambient temperature of 30°C)

	With air conditioning	Without air conditioning
Head region	23 °C	42 °C
Chest region	24 °C	40 °C
Footwell	30 °C	35 °C

1.7 Environmental aspects

Since about 1992, air conditioning systems have been progressively adapted to use R134a refrigerant gas. This gas does not contain chlorine and is thus harmless to the ozone layer.

Up to about 1992, air conditioning systems used to use R12 refrigerant gas. This FHC has a high potential for depleting the ozone layer due to its chlorine atoms, as well as a high potential for intensifying the greenhouse effect.

For environmental reasons, releasing the refrigerant gas into the atmosphere is prohibited (please refer to legislation and standards) ⇒ page 32 .

1.8 Air conditioning effects

Cabin temperature is determined by solar radiation passing through the windows and by heat transfer through the metal components. To ensure passenger comfort on extremely hot days, it is necessary to eliminate part of the existing heat.

Considering that heat propagates to wherever the temperature is lower, a component generating low temperatures is placed in the cabin. Inside this component, the refrigerant gas evaporates constantly. The heat necessary for this to happen is extracted from the air circulating through the evaporator.

The refrigerant gas that absorbs the heat is pumped by the air conditioning compressor. The compressing action of this component increases the thermal rate and the temperature of the refrigerant gas. Now its temperature is significantly higher than ambient temperature.

Refrigerant gas enters the condenser at high temperature. Due to the temperature gradient between the gas and outside temperature, the gas releases heat to the environment through the condenser.

Refrigerant gas is thus a transport medium for the thermal load. As the gas becomes necessary again, it returns to the evaporator.

Accordingly, the basic principle of any air conditioning system is a refrigerant gas loop The differences are in the composition of the components.

1.9 Safety at work

1.9.1 Product characteristics

Refrigerant gas used in automobile air conditioning systems belongs to a new generation of refrigerant gases based on chlorine-free, partially fluorinated hydrocarbons (H-FKW, R134a).

In terms of its physical reaction, it is a refrigerant gas liquefied under pressure. These gases must comply with regulations on pressure tanks and can only be used in pressurized containers which have been duly certified and identified.

Their proper, safe use depends on certain conditions that must be complied with.

1.9.2 Handling refrigerant gas

WARNING

Freezing Hazard.

- *Never open containers or lines containing refrigerant gas as it may be released in liquid or vapour form and cause severe injuries through freezing.*
- *Work on the refrigerant gas loop should be carried out only in well-ventilated locations. Turn on any exhaust systems in the workshop. Never inhale refrigerant gas vapours.*
- *Fires, open flames and smoking are strictly prohibited. The substances resulting from burning refrigerant gas are highly toxic and corrosive.*
- *Soldering work on loaded air conditioning components is prohibited. This also applies to other work carried out in vehicles where there is a danger of heating air conditioning components.*

If containers of refrigerant gas are opened, the contents may be released as liquid or vapour. The stronger the pressure inside the container, the greater the intensity with which the gas will be released.

Pressure depends on two conditions:

- The type of refrigerant gas in the container: "The lower the boiling point, the greater the pressure will be."
- Recorded temperature: "The higher the temperature, the greater the pressure."

1.9.3 Wear protective goggles

Wear protective goggles. Goggles prevent the refrigerant gas from coming into contact with the eyes, thus avoiding the occurrence of serious injuries caused by freezing

1.9.4 Use protective gloves and apron

Refrigerant gases easily dissolve oils and fats Therefore, when they come into contact with skin, they eliminate its protective layer. Dry skin is very sensitive to cold and bacteria.

1.9.5 Refrigerant gas should never come into contact with skin

The heat necessary for evaporation is retrieved by the refrigerant gas from the environment in which it finds itself, even if this is the skin. In this case, an extremely low temperature can be reached The result is localized freezing (the boiling point of R134a is -26 5 °C at ambient pressure).

1.9.6 Never inhale refrigerant gas vapours

Note

Refrigerant gas vapours released in higher concentrations blend with the surrounding locally, and reduce the oxygen available for breathing.

1.9.7 Smoking is strictly prohibited

Refrigerant gas can decompose in the burning end of a cigarette. The resulting substances are toxic and must not be inhaled.

1.9.8 Soldering work in refrigeration systems

Before doing any soldering in the vehicle (near components of the air conditioning system), remove the refrigerant gas and eliminate all existing residues.

Soldering work on loaded air conditioning components is prohibited. This also applies to other work carried out in vehicles where there is a danger of heating air conditioning components.

1.9.9 Active smell

The presence of an active smell indicates the formation of the above mentioned decomposition products. It is essential that such products are not inhaled, as they may cause injuries to the respiratory tract, lungs and other organs.

1.9.10 First Aid

- In case of contact with the eyes or mucous membranes, wash immediately with running water and consult an eye doctor.
- In case of contact with the skin, immediately take off all contaminated clothes and wash the exposed areas with plenty of water.
- In case refrigerant gas vapours are inhaled in large quantities, the victim must be immediately taken outside to breathe fresh air, and a doctor must be called right away. If the victim has difficulty breathing, provide oxygen. If the victim has great difficulty breathing or has stopped breathing, tilt the head backwards and carry out mouth-to-mouth resuscitation. (These procedures must only be carried out by qualified individuals.)

1.9.11 Handling of pressurized tanks

WARNING

- *Refrigerant gas must not be stored in confined or underground locations (such as ditches), close to air intakes or windows, and emergency exit ways.*

- Fasten the tanks to prevent them from falling!

Fasten bottles stored vertically to prevent them from falling, and bottles stored horizontally to prevent them from rolling

- Do not throw the tanks!

If they fall, the tanks may become deformed and there may be leakage of refrigerant gas or even explosions, which could lead to serious injuries.

Inappropriate transportation conditions may cause damage to the tank valve. To make sure the tank valves are protected, they should only be transported with protective caps.

- Tanks should not be placed next to heating units or exposed to direct sunlight!

Temperatures near heating units may get very high. Higher temperatures mean higher pressure, with a risk of exceeding the maximum pressure supported by the container.

1.9.12 Do not heat above 50 °C

To eliminate potential risks, legislation on pressurized tanks prohibits subjecting them to temperatures above 50 °C.

1.9.13 Monitor the heating process

Never heat tanks. Localized overheating may cause structural modifications inside the tanks, decreasing the pressure exerted on them. Localized overheating also involves a risk of decomposition of refrigerant gas.

1.9.14 Close empty containers

Empty tanks must be closed in such a way that humidity is prevented from entering. Humidity causes oxidation, which weakens the tank walls. Furthermore, rust particles carried from the tank to the refrigeration system may cause damage.

1.9.15 Safety measures related to handling refrigerant gas suction and filling equipment

- Before connecting the filling system to the air conditioning loop, make sure that the existing cut-off valve is closed.
- Before disconnecting the filling system from the air conditioning, be sure that the procedure has been fully completed, thus preventing the release of refrigerant gas into the atmosphere.
- After transferring the purified refrigerant gas from the filling system to an external pressurized tank, close the manual cut-off valves on the tank and on the filling system.
- The filling system should not be exposed to humidity or be used in humid areas.
- Switch off power supply before carrying out any maintenance work on the filling system.
- To lower the fire hazard, avoid using an extension lead If this cannot be avoided, use a cable with a minimum cross-section of 2 5 mm^2
- In case of fire, remove the external tank
- The oil transferred by the suction accumulator from the air conditioning system to the jointly delivered measuring cup must be stored in a covered container, as it contains a small amount of refrigerant gas, which cannot be released into the environment

- After the air conditioning service station is disconnected, it must be well fastened to avoid any risk of accidents

1.9.16 Safety measures related to the works to be performed in vehicles with air conditioning and the handling of R134a refrigerant gas

WARNING

- *We recommend that you always have a solution to wash your eyes.*
- *The works to be performed in the circuit of the refrigerant shall be done only in ventilated locations and with the use of proper protection equipment.*

Note

- *Seal the components or flexible tubes removed so that they can be protected from humidity and impurities.*
- *Use only tools and materials duly certified by VW.*
- *The operation of the engine can only be made with the refrigeration gas circuit completely assembled.*
- *The air conditioning compressor is always activated by the pulley connected to the crankshaft.*
- *In case of blockage, the overload protection of the air conditioning compressor is activated. Even if no deformations in the compressor overload protection pulley is visible, the compressor can be blocked.*
- *It is only possible to start the engine if the refrigerant gas circuit is assembled correctly. If, for instance, the rigid lines of the refrigerant gas are not connected to the compressor, it may heat so much with the engine running (due to internal heating) that it will be damaged.*

2 General remarks on the refrigerant gas loop

2.1 Refrigerant gas loop components

Caution

The non-authorized tools or material (such as contrast) may cause damage to the system.

Only the tools and material recommended by the manufacturer should be used, otherwise, besides damage to the system, the right to warranty may also be nullified.

- All components of the refrigerant gas loop sent for quality evaluation should be properly closed (use the original closing plugs of the replacement part).
- Replace all damaged and leaky components of the refrigerant gas loop ⇒ page 80 .

2.1.1 Distribution of refrigerant gas loop components and their influence on the high and low pressure areas.

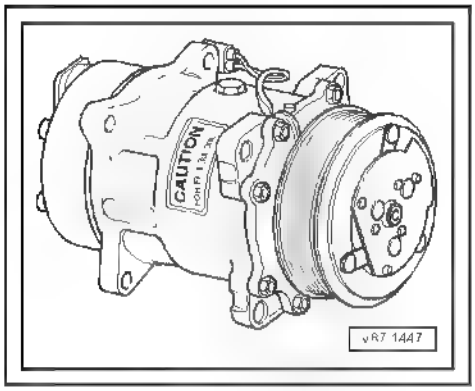
The liquid tank condenser is assembled in the high pressure area; separation between the liquid in the low and high pressure areas is achieved with a butterfly (throttle) or expansion valve.

Excessive filling with refrigerant gas or cooling gas oil, as well as a dirty condenser, damaged fan radiator, clogged system or humidity penetration in the cooling gas loop (ice formation on the butterfly (throttle) or on the expansion valve) are all factors that produce excessive pressure.

The evaporator, the collection loop and the temperature sensor of the evaporator are located in the low pressure area; separation between the high pressure gas area and the low pressure gas area is implemented by the compressor.

The system pressure can decrease together with loss of refrigerant gas due to a leak in the butterfly (throttle) and/or expansion valve (throttle zone), due to malfunction in the compressor or the presence of ice in the evaporator.

2.1.2 Air conditioning compressor with magnetic coupling:



The air conditioning compressor is activated by the engine of the vehicle, by means of a splined trapezoidal belt

When the air conditioning is switched on, a magnetic coupling in the air conditioning compressor is responsible for adherence between the pulley of the splined trapezoidal belt and the pulley of the air conditioning compressor

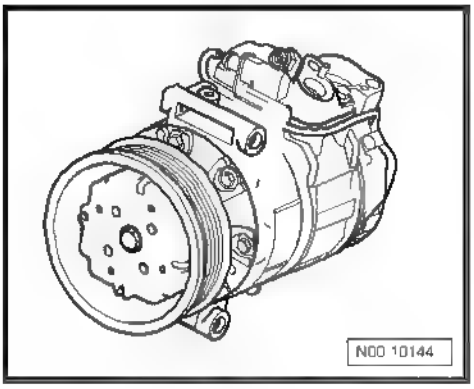
The fuse in the pulley of the splined trapezoidal belt of the air conditioning compressor activates a magnetic coupling and, in the event that the air conditioning compressor locks, it protects the mechanism from any overload.

The air conditioning compressor sucks the refrigerant gas from inside the evaporator, and transfers it to the condenser.

Note

- *The air conditioner compressor contains oil mixable with R134a refrigerant gas at all temperatures.*
- *The type of refrigerant gas used in the compressor is shown on the manufacturer's nameplate. There is an adjustment valve for adjusting the pressure in the low pressure area to values within the predicted nominal values (characteristic regulating curve).*
- *To prevent the compressor from suffering any damage when the refrigerant gas loop is empty, disconnect the electromagnetic valve and do not activate the Adjustment valve for the air conditioning compressor - N280- (the compressor starts at idle speed together with the engine).*

2.1.3 Air conditioning compressor without magnetic coupling



The air conditioning compressor is activated by the engine of the vehicle, by means of a splined trapezoidal belt

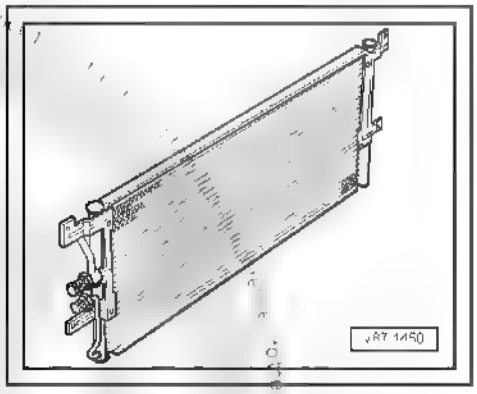
The fuse (for protection against shearing) in the pulley of the splined trapezoidal belt of the air conditioning compressor activates a magnetic coupling and, in the event that the air conditioning compressor locks, it protects the mechanism from any overload.

The air conditioning compressor sucks the refrigerant gas from inside the evaporator, and transfers it to the condenser.

Note

- *The air conditioner compressor contains oil mixable with R134a refrigerant gas at all temperatures.*
- *The type of refrigerant gas used in the compressor is shown on the manufacturer's nameplate. There is an adjustment valve for adjusting the pressure in the low pressure area to values within the predicted nominal values (characteristic regulating curve).*
- *In this type of air conditioning compressor, the adjustment valve is operated from outside.*
- *The engine must only be started if the refrigerant gas loop is properly assembled.*
- *In order to avoid damage to the air conditioning compressor when the refrigerant gas loop is empty, it is equipped with an oil supply system. This means that 40 to 50 cm^3 of refrigerant gas oil remain in the air conditioning compressor.*

2.1.4 Condenser



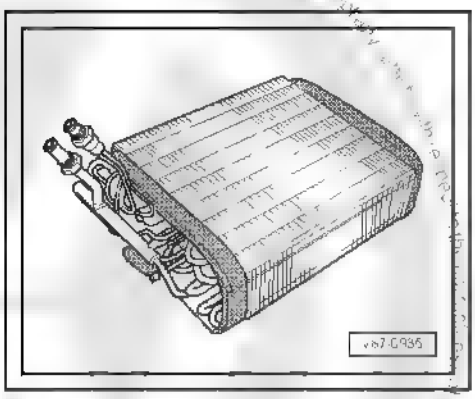
The condenser releases, outside the vehicle, the heat produced by the compressed refrigerant gas.

In this process, condensed refrigerant gas turns into liquid.

2.1.5 Evaporator

The refrigerant gas in its liquid state evaporates in the evaporator coils. The heat necessary for this operation is extracted from the air circulating through the fins of the cooling evaporator. The refrigerant gas evaporates and is sucked in by the compressor, together with the absorbed heat.

The butterfly (throttle) or expansion valve transfers a predetermined amount of refrigerant gas to the evaporator. In systems equipped with an expansion valve, the flow is regulated so that the refrigerant gas turns to a gaseous state only when it exits the evaporator.



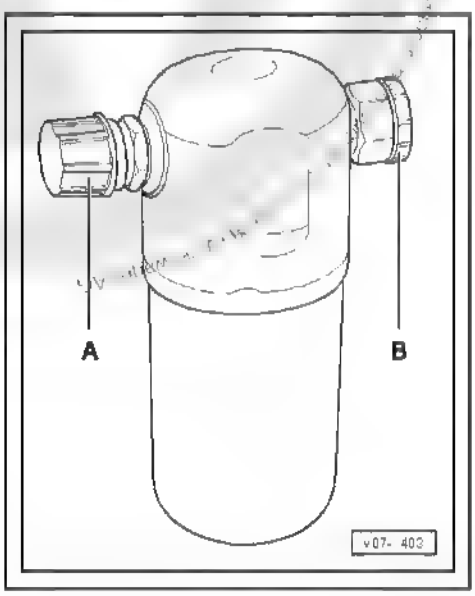
2.1.6 Collection tank

To ensure that the air conditioning compressor only sucks refrigerant gas in its gaseous state, the collection tank absorbs the vapour-gas mixture coming from the evaporator. From the vapour, refrigerant gas in its gaseous state is obtained.

The refrigerant gas oil in the loop does not remain in the collection tank, as there is a vent for oil suction.

Humidity that may have seeped into the refrigerant gas circuit during assembly is absorbed by the tank filter.

Both refrigerant gas in its gaseous state and oil are sucked by the compressor.

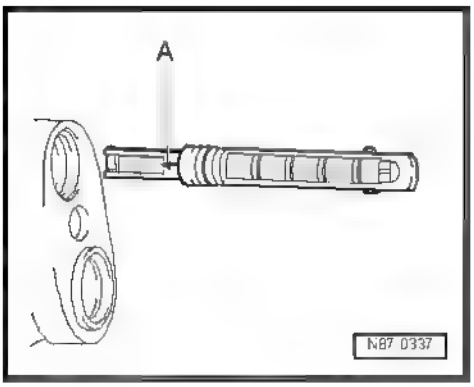


Note

- *The collection tank should be replaced if the refrigerant gas loop has remained open for an extended period of time (longer than normal repair time) and/or humidity has entered the system; or if this is advised by specific recommendations* *⇒ page 80* .
- *Closing plugs -A- and -B- should only be removed immediately before assembly.*
- *When the collection tank is not closed, the internal element rapidly becomes saturated due to humidity absorption, and is thus rendered useless.*
- *During assembly, pay attention to the arrow indicating the direction of the refrigerant gas flow.*

2.1.7 Butterfly (throttle)

The butterfly (throttle) forms a constriction that controls the passage and divides the refrigerant gas loop into two sections: high and low pressure. Before the butterfly section (throttle), the refrigerant gas heats up due to the high pressure. After the butterfly section (throttle), the refrigerant gas cools down due to the low pressure. Before the constriction section, a filter collects all existing impurities; after the constriction another filter atomizes the refrigerant gas before it enters the evaporator.

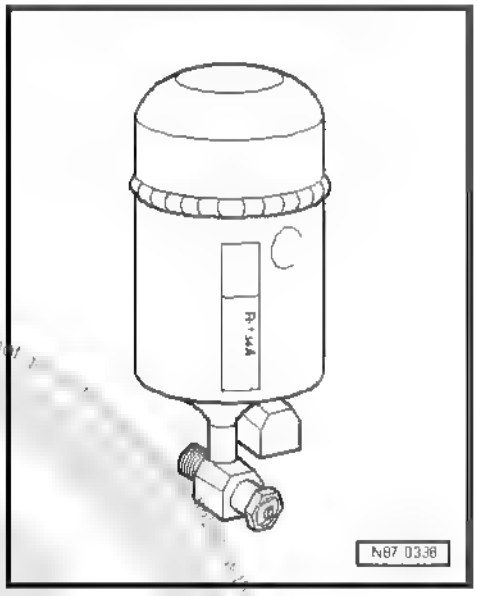


Note

- *Arrow -A- on the butterfly (throttle) points to the evaporator.*
- *Replace every time the refrigerant gas loop is opened.*

2.1.8 Liquid tank

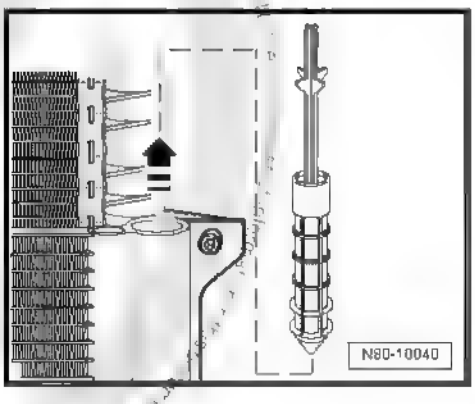
The liquid tank collects the drops (minimal water amount) and directs them continuously to the expansion valve. Humidity that may have entered into the refrigerant gas loop during assembly is collected in the tank.



Note

- *Replace the collection tank should the refrigerant gas loop have remained open for an extended period of time (longer than normal repair time) and/or humidity has entered the system; or if this is advised by specific recommendations* *⇒ page 80 .*
- *The closing plugs should only be removed immediately before assembly.*
- *Internal components soon become saturated due to humidity absorption whenever the liquid tank is not closed, thus becoming unusable.*
- *During assembly, pay attention to the arrow indicating the direction of the refrigerant gas flow.*

Current liquid tanks are assembled directly on the condenser.

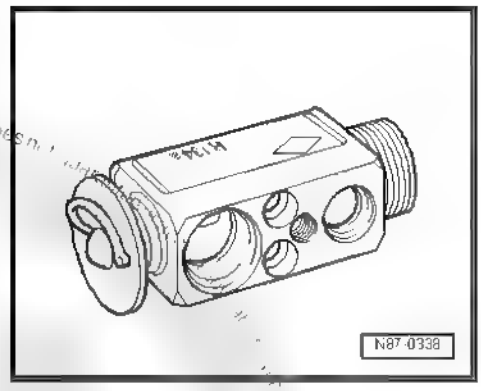


Note

- *The cartridge must be replaced if the refrigerant gas loop has remained open for an extended period of time (longer than the normal repair time) and/or if humidity has entered the system; or if this is advised by specific recommendations* *⇒ page 80 .*
- *Remove the cartridge from its packaging only immediately before assembly*
- *When the collection tank is not closed, the internal component rapidly becomes saturated due to humidity absorption, and is thus rendered useless.*

2.1.9 Expansion valve

The expansion valve dissipates the influx of refrigerant gas, thus regulating its flow in such a manner that the vapour, depending on heat transport, only turns into its gaseous state when it exits the evaporator



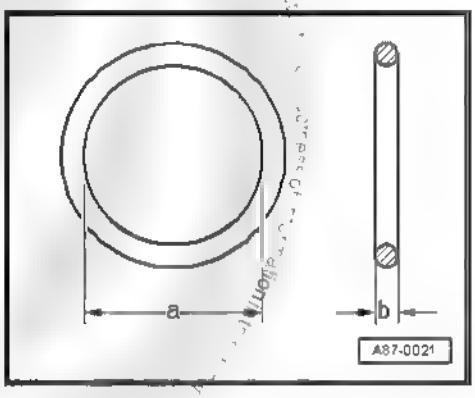
2.1.10 O-ring seals

These O-rings seal the connection areas between the different components of the refrigerant gas loop.

Only O-rings resistant to R134a refrigerant gas and its respective oil may be assembled. Original spare parts are compatible.

O-ring seals:

- As a rule, whenever you open any air conditioner connection, the O-rings must be replaced.
- Observe the correct diameter -a- and -b-.
- Before assembly, moisten with refrigerant gas oil.



Note

The colour markings of O-rings for refrigerant gas loop with R134a are no longer in use. Black and coloured O-rings are now used.

2.1.11 Rigid tubes and flexible tubes in the refrigerant gas loop

The mixture of oil and R134a refrigerant gas is corrosive to some metals (for example: copper) and alloys, dissolving certain flexible tubes. Therefore, original replacement parts should always be used.

The junction between rigid and flexible tubes comprises of threaded joints or special connections.

Note

If threaded joints are used, observe the indicated torque; in case of special connections, use assembly and disassembly tools.

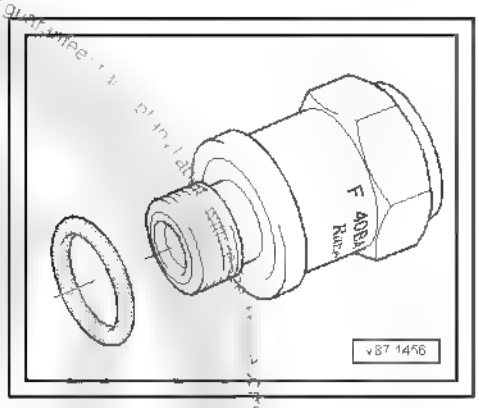
2.1.12 Overpressure valve

The overpressure valve is mounted on the compressor or on the liquid tank.

At an approximate pressure of 38 bar, the valve opens and closes again when the pressure decreases (approx 30 bar).

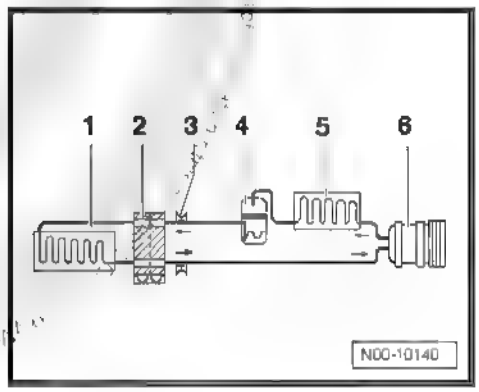
The refrigerant gas does not flow out completely

Depending on the model, there may be a transparent plastic washer that breaks when the valve is activated.



2.2 Refrigerant gas loop components

2.2.1 Refrigerant gas loop with expansion valve and evaporator

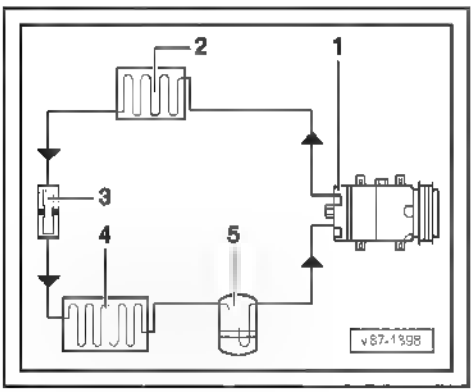


1 - Evaporator
2 - Expansion valve
3 - Suction valve, filling and measuring
4 - Liquid tank with cartridge
5 - Condenser
6 - Air conditioner compressor

Note

The arrows show the direction of the refrigerant gas flow.

2.2.2 Refrigerant circuit with butterfly (throttle) and collection tank



1 - Air conditioner compressor
2 - Condenser
3 - Butterfly (throttle)
4 - Evaporator
5 - Collection tank

Note

The arrows show the direction of the refrigerant gas flow.

2.3 Quick coupling connections in the refrigerant gas loop

> **WARNING**
>
> *Freezing Hazard.*
>
> *If the refrigerant gas loop is not empty, spillages will occur.*
>
> *Suck the refrigerant gas out before opening the loop. If the refrigerant gas loop is not opened within 10 minutes after suction, then pressure may build up in the loop due to later evaporation. Suck the refrigerant gas out once more.*

- Only O-rings resistant to R134a refrigerant gas and to its respective oil may be assembled.
- There are distinct connections for the high and low pressure areas (outside diameter).
- As a matter of principle, secure the closing lids.

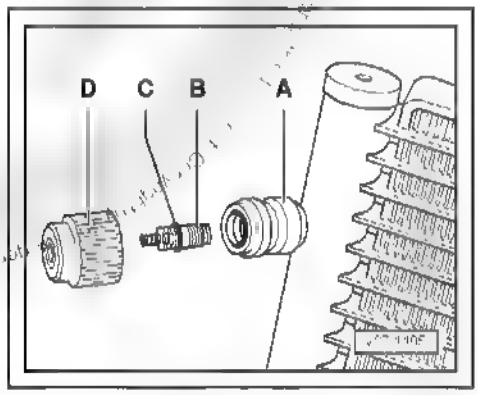
2.3.1 Suction and filling valve with Schrader valve

A - Service terminal (soldered)

B - Schrader valve fit

C - O-ring seal (corresponding to the valve)

D - Closing lid with sealing



2.3.2 Suction and filling valve, high pressure section

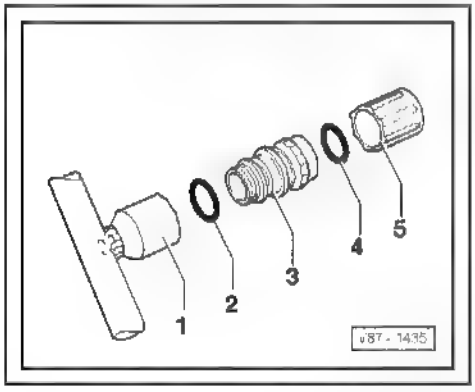
1 - Bearing shell with outer and inner thread

2 - O-ring: 10.8 mm; 1.8 mm identification: black or coloured

3 - Suction and filling valve with O-ring groove and outer or inner thread M 8x1 for lid (7 ± 072 Nm)

4 - O-ring: 10.8 mm; 1.8 mm identification: black or coloured

5 - Cap



2.3.3 Suction and filling valve, low pressure section

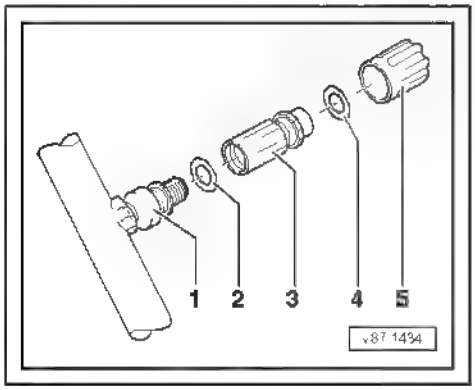
1 - Bearing shell with outer thread and O-Ring groove

2 - O-ring: 7.6 mm; 1.8 mm identification black or coloured

3 - Suction and filling valve, inner thread for lid M 8x1 (7 ± 0 7 Nm)

4 - O-ring: 7.6 mm; 1.8 mm identification black or coloured

5 - Cap



2.4 Switches and sensors for the refrigerant gas loop and their connections

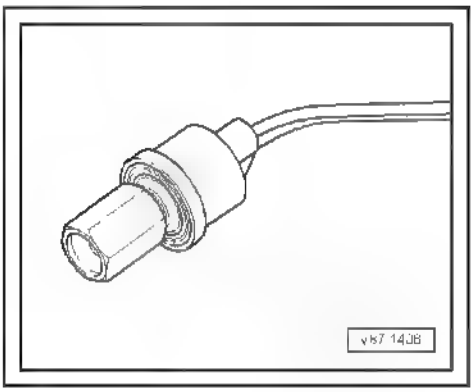
Note

Activation pressures, Switches - Disassemble and assemble, locations of switches and their respective versions, refer to each vehicle's specific refrigerant gas loop ⇒ Heating, air conditioning; Rep gr. 87 ; Air conditioning .

2.4.1 High pressure switch for air conditioning system - F23-

Operation:

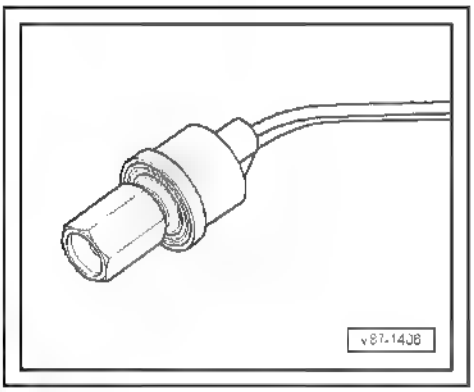
It activates the next speed level of the refrigerant liquid fan when the pressure in the refrigerant gas loop increases (approximately 16 bar).



2.4.2 High pressure switch for magnetic clutch - F118-

Operation:

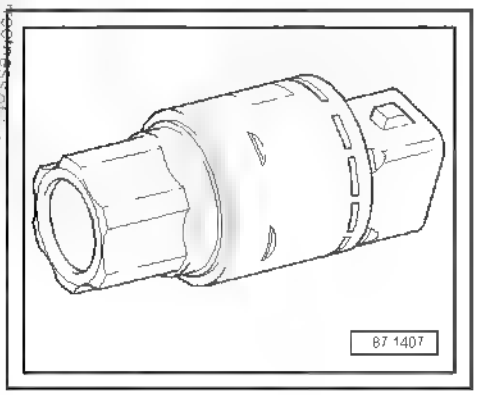
It switches off the air conditioning compressor in case of overpressure in the refrigerant gas loop (from approximately 32 bar).



2.4.3 Low pressure switch for air conditioning system - F73-

Operation:

It switches off the air conditioning compressor in case of pressure loss in the refrigerant gas loop (from approximately 2 bar).



2.4.4 Valve connections for switch in the refrigerant gas loop

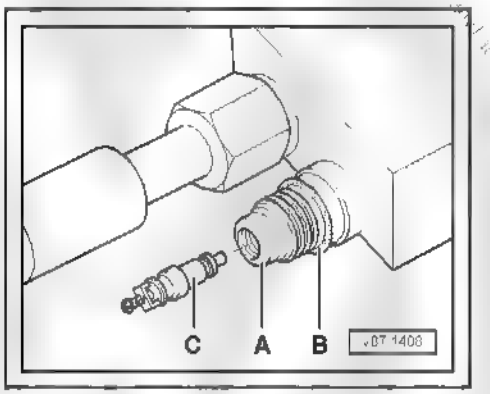
> **WARNING**
>
> *Freezing Hazard.*
>
> *If the refrigerant gas loop is not empty, spillages will occur*
>
> *It is necessary to vacuum the refrigerant prior detaching valve -C-. If the refrigerant circuit is not opened within 10 minutes after vacuuming, then pressure may build up in the loop due to posterior evaporation. Suck the refrigerant gas out once more.*

- The switches for the high pressure and low pressure areas have different threads.
- Only valves and O-ring seals resistant to R134a refrigerant gas and to its respective oil may be assembled.

A - Terminal (soldered)

B - O-ring seal

C - Valve (with O-ring seal)



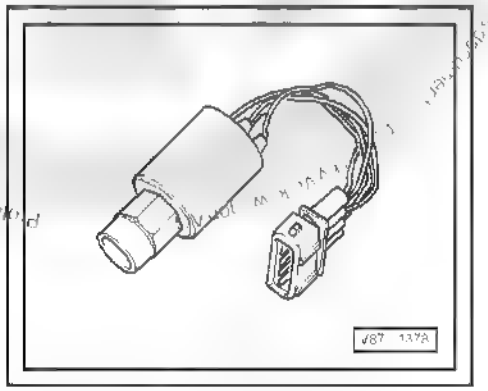
2.4.5 Air conditioning system pressure switch - F129-

This pressure switch has three functions:

1. It activates the next ventilation speed level of the refrigerant liquid when the pressure in the refrigerant gas loop increases (approximately 16 bar).

2. It switches off the air conditioning (for example, if the engine is insufficiently cooled) in case of excessively high pressure (approximately 32 bar).

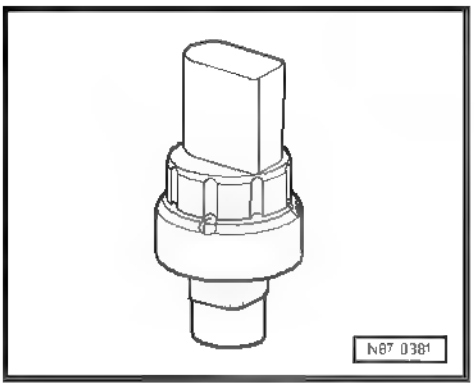
3. It switches off the air conditioning (for example, due to loss of refrigerant gas) in case of excessively low pressure (approximately 2 bar).



Note

The Air conditioning pressure switch - F129- replaces the Air conditioning high pressure switch - F23- , the Air conditioning low pressure switch - F73- and the High pressure switch for magnetic coupling - F118- .

2.4.6 High pressure sender - G65-



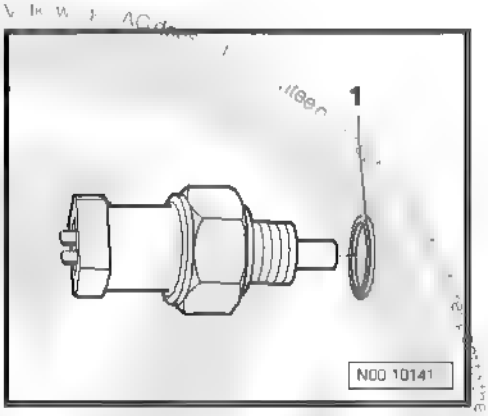
This High pressure sensor - G65- is assembled to replace the Air conditioning pressure switch - F129- .

This high pressure sensor produces a rectangular signal or a data packet when switched on. This signal changes according to the pressure in the system

This signal allows the controlling devices turned on at a later time (the liquid refrigerant fan controller, motor controller Air conditioning system control and display unit / Climatronic - E87- or Climatronic control unit - J255- among others) to establish the pressure in the refrigerant circuit, by activating the refrigerant fan, the motor and the Air conditioning magnetic clutch - N25- as needed, with the additional option of altering the operation of the Adjustment valve for the air conditioner compressor - N280- .

2.4.7 Refrigerant pressure and temperature sender - G395-

> **WARNING**
>
> *Freezing Hazard.*
>
> *If the refrigerant gas loop is not empty, spillages will occur.*
>
> *The refrigerant gas must be sucked out before disassembling the Pressure and temperature sensor for the cooling gas - G395- . If the refrigerant gas loop is not opened within 10 minutes after suction, pressure may build up in the loop due to later evaporation. Suck the refrigerant gas out once more.*



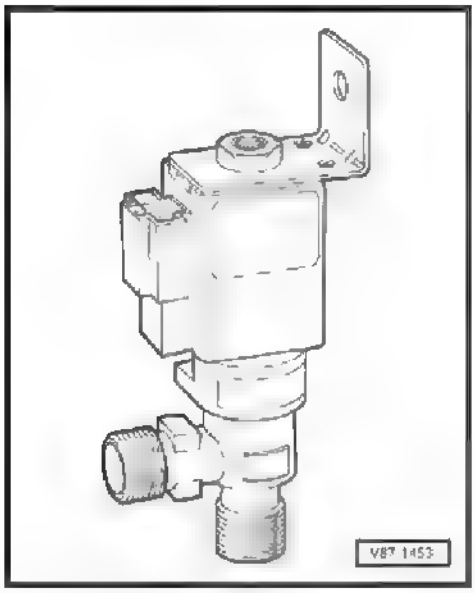
This Pressure and temperature sensor for the refrigerant gas - G395- is assembled as a replacement for the High pressure sensor - G65- or the Air conditioning pressure switch - F129- .

The pressure signal is permanently verified, whereas the temperature signal is only accessed at temperatures above 0 °C.

The Climatronic control unit - J255- operates based on those values, activating the refrigerant liquid fan and the Adjustment valve for the air conditioning compressor - N280- as needed.

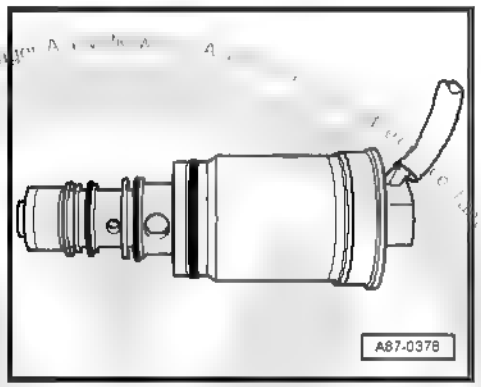
2.4.8 Magnetic valve for liquid refrigerant circulation - N43-

The passage of the refrigerant liquid through the second evaporator is regulated by the electromagnetic valve. The valve opens, activated by the command and regulating unit, if there is voltage present



2.4.9 Air conditioner compressor regulating valve - N280-

The adjustment valve is integrated in the compressor. It is activated by the Air conditioning command and indicator unit / Climatronic - E87- or by the Climatronic control unit - J255- . The adjustment valve influences the pressure in the low pressure section, thus regulating the temperature in the evaporator.



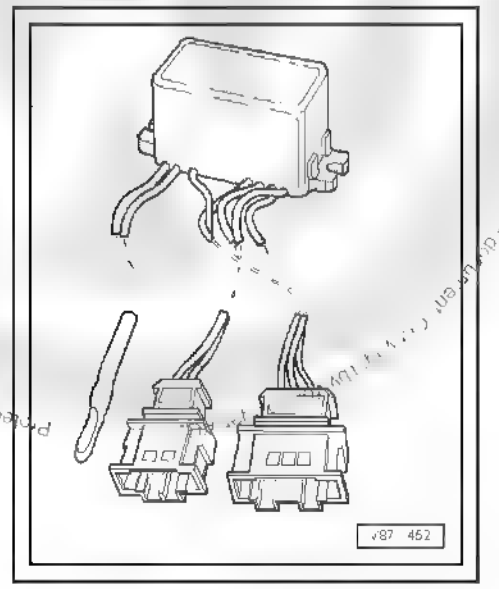
Note

The Adjustment valve for the air conditioning compressor - N280- is an integral part of the compressor and cannot be replaced separately.

2.5 Electrical components not assembled in the refrigerant gas loop

2.5.1 Control and regulating unit for air conditioning system - J127-

This control and adjustment unit blocks the passage of refrigerant gas through the evaporator if the temperature of the evaporator cooling fins decreases to the freezing point of water (protection against freezing).

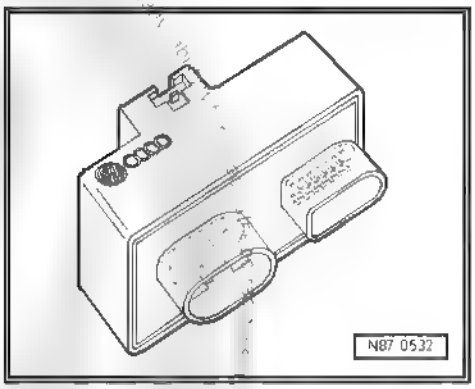


2.5.2 Radiator fan control unit - J293-

Note

It is available in different formats, separately or mounted on the radiator fan.

This control device switches on and off the magnetic coupling and, thus, the compressor. It activates the refrigerant liquid fan and, in vehicles equipped with a High pressure sensor - G65- or a Pressure and temperature sensor for the refrigerant gas - G395- , it calculates the pressure in the refrigerant gas circuit.

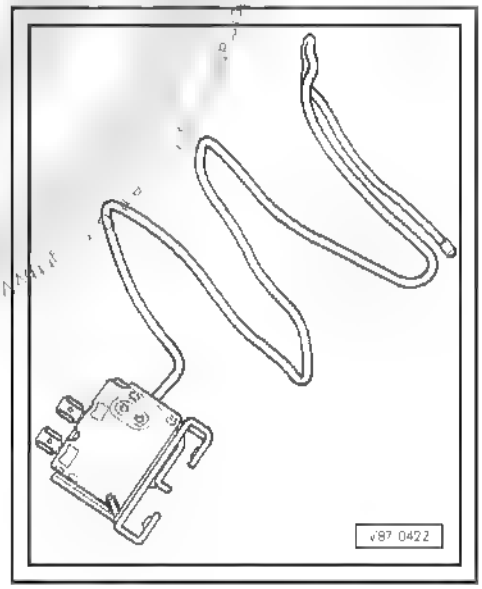


2.5.3 Temperature switch for evaporator - E33-

Operation:

The Evaporator temperature switch - E33- calculates the temperature between the evaporator's cooling fins. It avoids the formation of ice between the evaporator cooling fins by interrupting the power supply to the magnetic coupling of the air conditioning compressor, whenever the temperature of the cooling fins reaches the freezing point of air humidity.

The fitting depth for the rigid filling tube is shown or indicated in the repair manual⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .



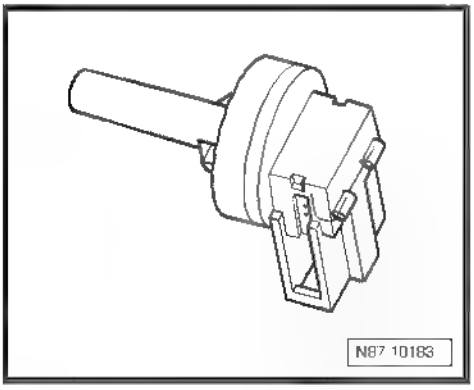
Note

Component assembled in vehicles in which the air conditioning compressor is operated by a splined trapezoidal belt.

2.5.4 Air outlet temperature sensor for the evaporator - G263- or Evaporator temperature sensor - G308-

Operation:

The Air outlet temperature sensor for the evaporator - G263- or the Evaporator temperature sensor - G308- checks the evaporator's temperature. This value is transmitted to the air conditioning control device, which relies on it as a reference signal to regulate the air conditioning compressor This prevents the evaporator from freezing



2.6 Pressures and temperatures in the refrigerant gas loop

> **WARNING**
>
> *When carrying out work on the refrigerant gas loop, please observe general safety standards and regulations related to pressurized tanks.*

Pressures and temperatures recorded in the refrigerant gas loop vary depending on operational conditions (for example, engine speed, refrigerant liquid fan speed, engine temperature, compressor on or off) and on environmental factors (such as ambient temperature, humidity, requested refrigeration power)

In vehicles with Adjustment valve for the air conditioning compressor - N280- , the pressure on the low pressure side is altered by the operation of the valve.

For this reason, the following values must only be considered as a reference. These values are reached after 20 minutes, at an engine speed of between 1,500 and 2,000 rpm and at an ambient temperature of 20 °C.

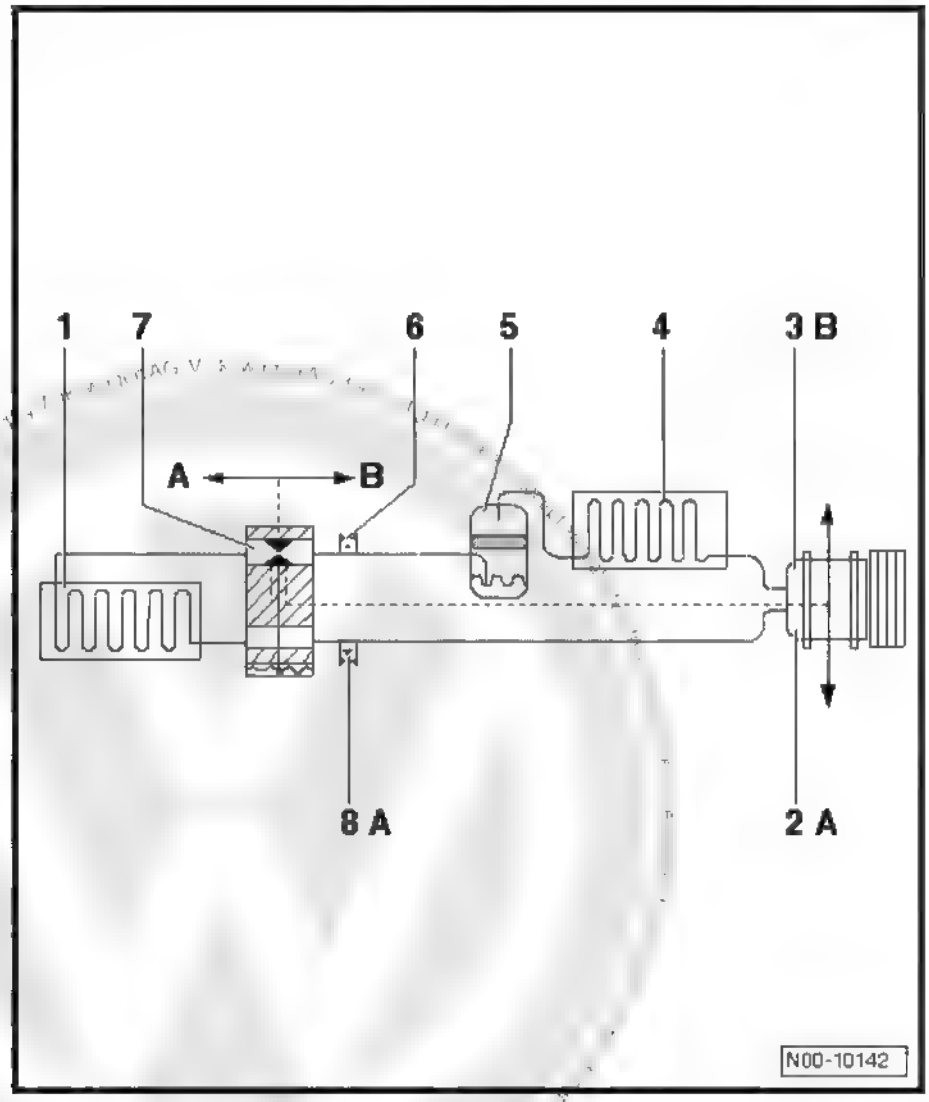
The connections necessary to measure the pressure are found in the specific refrigerant gas loop of each vehicle⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .

At a temperature of 20 °C and with the engine stopped, the pressure in the refrigerant gas circuit reaches 4.7 bar ⇒ page 3 .

2.7 Refrigerant circuit with expansion valve

A - Low pressure section of the refrigerant gas loop

B - High pressure section of the refrigerant gas loop.



Component	Refrigerant state	Pressure (in bar)	Temperature (in degrees Celsius)
-1- Evaporator, from intake to outlet	Vapour	approx. 1.2 bar [1)] (approx. 1.8 bar)[3)]	approx. -7 °C [2] approx. -1 °C [3)]
-2- Compressor, section -A-	Gas	approx. 1.2 bar [1)] (approx. 1.8 bar)[3)]	approx. -1 °C approx. +1 °C [3)]
-3- Compressor, section -B-	Gas	approx. 14 bar	approx. +65 °C
-4- Condenser	Gas, Vapour, Liquid	approx. 14 bar	at outlet approx. + 55 °C
-5- Liquid tank	Liquid	approx. 14 bar	approx. +55 °C
-6- Filling and suction valve, section -B-	Liquid	approx. 14 bar	approx. +55 °C

Component	Refrigerant state	Pressure (in bar)	Temperature (in degrees Celsius)
-7- Expansion valve	Liquid, pressure relief in form of vapour	approx. 14 bar	approx. + 55 ° C, reduces to -7 °C
-8- Filling and suction valve, section -A-	Gas	approx. 1.2 bar [1] (approx. 1.8 bar)[3]	approx. -7 °C [2] approx. -1 °C [3]

1) Inside the refrigerant gas loop with regu ated compressor, the pressure is ma ntained at approx. 2 bar, regardless of the changes in heat conduction and engine speed regimes. This standard only applies to compressor power; if compressor power limits are exceeded, the pressure will rise ⇒ page 42 .

2) In the refrigerant gas loop with an adjusted compressor, the temperature is kept within the adjustment limits of the compressor, regardless of alterations of heat transport and engine speed. This standard only applies to compressor power; if the compressor's power limits are exceeded, the temperature will rise ⇒ page 42

3) Measurement values for air cond tioning devices with two evaporators

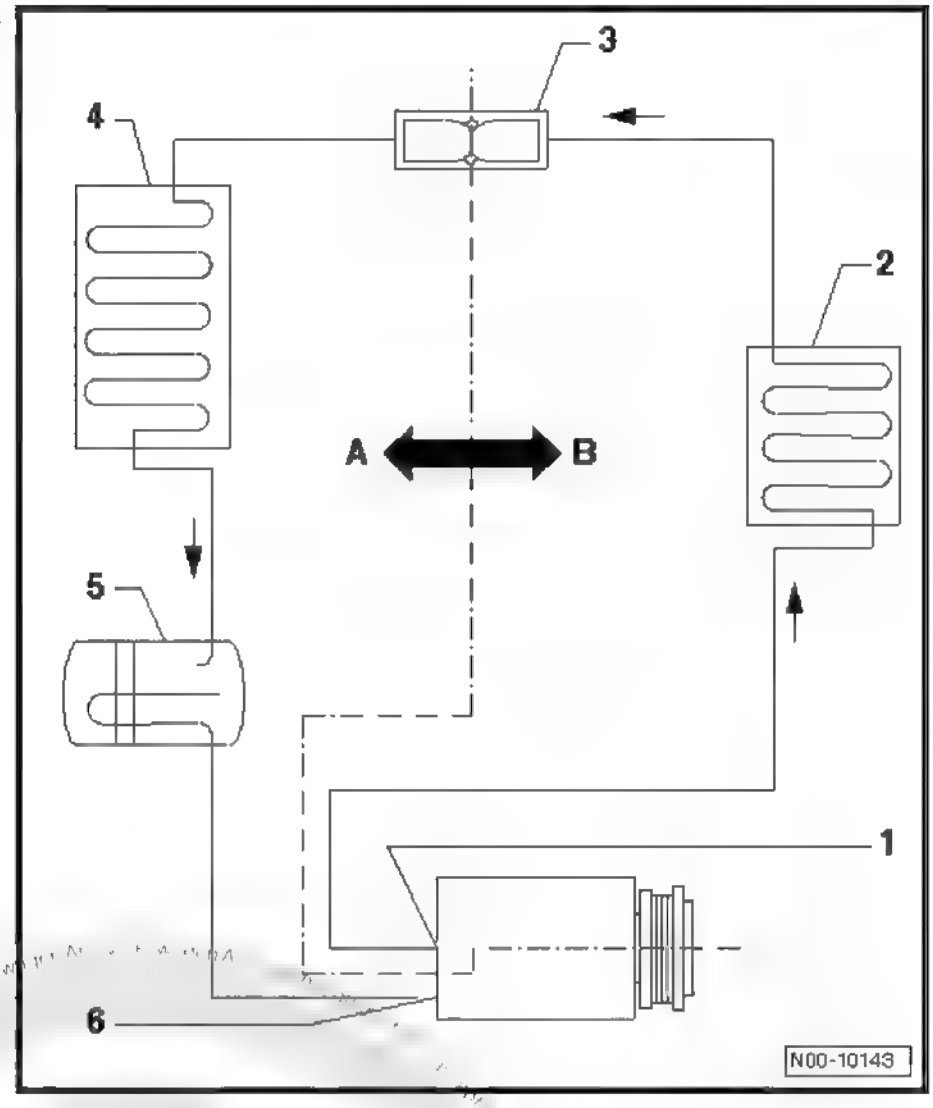
Note

- *Compressors without a self-adjusting power system are switched off by their command device, via the Adjustment valve for the air conditioning compressor - N280- , as soon as the evaporator temperature decreases below 0 °C.*
- *In vehicles with Adjustment valve for the air conditioning compressor - N280- , the pressure on the low pressure side is altered by the operation of the valve.*

2.8 Refrigerant circuit with butterfly (throttle) and collection tank

A - Low pressure section of the refrigerant gas loop

B - High pressure section of the refrigerant gas loop.



Component	Refrigerant state	Pressure (in bar)	Temperature (in degrees Celsius)
-1- Compressor, section -B-	Gas	up to 20 bar	up to + 70 °C
-2- Condenser	From gaseous to liquid state, with a vapour stage	up to 20 bar	up to + 70 °C
-3- Butterfly (throttle)	Transition from liquid to vapour state	Section -B- up to 20 bar, Section -A- above 1.5 bar	Section -B- up to 60 °C, Section -A- above - 4° C
-4- Evaporator	Transition from vapour to gaseous state	above 1 5 bar	above - 4 °C
-5- Collection tank	Gas		
-6- Compressor, section -A-	Gas		

The compressor "adjustment device" keeps the pressures measured at the low-pressure area at approx. 2 bar, regardless the changes in the engine speed regime level. This standard only applies to compressor power; if compressor power limits are exceeded, the pressure will rise ➔ page 42 .

Note

In vehicles with Adjustment valve for the air conditioning compressor - N280- , the pressure on the low pressure side is altered by the operation of the valve.

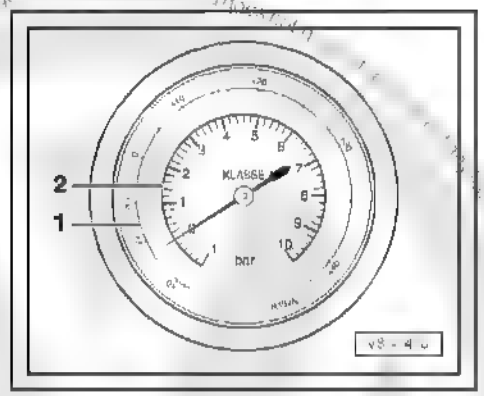
2.9 Checking and measuring work with a pressure gauge

Readout on the pressure gauge:

1 - Temperature scale for R134a refrigerant gas, CF3-CH2F or CH2F-CF3.

2 - Pressure scale

Pressure gauges may have one or more temperature scales, as well as the pressure scale. The values on the R134a scale are ordered according to the vapour pressure table. Considering that each refrigerant gas shows different vapour pressures at the same temperature, there is a temperature scale for each refrigerant gas.



2.9.1 Pressure gauges may be used to carry out the following checking and measuring work:

A - measuring pressure and temperature in the refrigerant gas loop:

- The high pressure gauge can be used to measure the pressure and temperature that spread evenly, with the air conditioning turned on, from the compressor outlet to the throttle or expansion valve, through the condenser.
- The low pressure gauge can be used to measure pressure and temperature that spread evenly, with the air conditioning turned on, from the throttling area or expansion valve to the compressor input, through the evaporator.

Note

The pressure / temperature ratio indicated on the pressure gauges only exists in sections in which the refrigerant gas loop agent is in its liquid or vapour state, but not in sections in which it is in its gaseous state. In its gaseous state, the temperature is near 10 °C to 30 °C higher than that shown by the pressure gauge.

B - Refrigerant gas sample in a closed container:

A given closed reservoir, or the refrigerant circuit, contains R134a if the temperature indicated on the pressure gauge corresponds to the refrigerant's temperature (the inert liquid is brought to room temperature).

A given closed tank, or the refrigerant gas loop when turned off, is empty when the temperature indicated by the pressure gauge is lower than the refrigerant gas temperature.

Note

The pressure / temperature ratio indicated by the pressure gauge is no longer valid if there is no liquid and the pressure is obtained through the action of vapour.

2.10 Notes on doing repair work on the refrigerant gas loop

WARNING

When carrying out work on the refrigerant gas loop, please observe general safety standards and regulations related to pressurized tanks.

Special tool and accessory:

To make sure that air conditioning repair work is carried out in accordance with the required technical expertise, please observe the following guidelines:

- Follow general guidance indications regarding leak detection devices ⇒ page 66 .
- Apply technical knowledge.

Note

Environmental contamination by refrigerant agents is punishable by law.

3 Legislation and standards

3.1 Legislation and standards

Note

- *The following legislation and standards are in force in Germany; in other countries, the applicable legislation may be different or more comprehensive*
- *In other countries, the relevant information sources must be obtained from the competent authorities.*

Operation, Maintenance, Immobilization, Collection laws:

During operation or maintenance and in case of immobilization of elements containing refrigerant gas, environmental contamination is strictly forbidden.

The quantities used during operation and maintenance must be duly registered (register book and/or refrigerant gas journal). See Volkswagen After Sales; ServiceNet; Manuals; HSQ (Service Organization Manual); Environment; Volume 2; Protection against emissions; Refrigerant from air conditioning systems / refrigerant oil). Records must be provided to competent authorities whenever requested.

Distributors of substances and mixtures are required to collect the same substances and mixtures after use or to designate a third party to carry out the collection.

Repair and immobilization work on elements containing refrigerant gas, as well as work related to collecting the above mentioned substances and mixtures, should only be carried out by specialized personnel with the required expertise and technical equipment.

Infractions and irregularities:

The legislation on chemical products considers that whoever, whether by premeditation or by negligence, in violation of this Article, while performing the duties of his/her profession and in particular while producing, repairing or immobilizing material containing refrigerant gas, disregarding the current state of technology, enabling the escape to the atmosphere of substances contained in such materials or, whether by premeditation or by negligence, fails to maintain the compulsory records, commits a violation

TRG (Technical Regulation - pressurized gases) 400, 401, 402:

Some extracts directly applicable to car manufacturers and workshops are reproduced below:

TRG 400 (General rules applicable to filling systems):

2. Concepts and explanations

2. 1 Filling systems.

2.1.1 Filling systems are systems used to fill mobile pressurized gas tanks Workshops, as well as their equipment, are considered as an integral part of the filling systems.

2. 4 Filling systems not requiring special authorization

Filling units without special authorization are all those filling units that perform the filling of mobile pressurized gas tanks for subsequent distribution to third parties

5. Filling systems that do not require special authorization include all those systems that perform the filling of mobile pressurized gas containers exclusively for company use

TRG 401 (Installation of filling units):

Not applicable to car manufacturers or workshops.

TRG 402 (Installation of filling units):

2 Personnel and personnel training

2. 1. Filling systems must only be handled and assisted by personnel

- at least 18 years old.
- with the necessary technical training qualifications.
- skilled at carrying out the assigned tasks.

2.2 Non-automatic tasks may be carried out by personnel as mentioned in item 2.1, paragraphs 1 and 2.

2.3 The personnel should receive proper training before beginning to work at the company, and then at regular intervals, at least once a year. Such training should cover primarily the following items:

- Hazards related to the handling of pressurized gases.
- Safety measures, in particular current technical regulations.
- Measures to be taken in case of malfunction, damage and accident.
- Handling of fire extinguishing equipment and protective equipment.
- Handling and assistance for filling systems, based on operating instructions;

Filling (tanks from other countries and the filling thereof should follow specific technical regulations):

The pressurized gas tank may only contain the gas mentioned on the tank itself, and the filling amount must be calculated based on pressure, weight or volume as shown on the tank (see article 15, paragraph 2 - Regulation on pressurized gas tanks).

Any reservoir indistinctly used for different types of pressurized gas must, prior to its being filled, receive indication of the gas type and, in case of a gas with ct ≥ -10 °C (ct = critical temperature), the indication of the maximum allowed filling pressure, in accordance with technical regulation TRG 104, number 3.3.

3. Pressurized gas tanks, where maximum filling pressure is expressed in bar, at a temperature of 15 °C, must be attested as to their pressure (by a pressure gauge). If, at the time of filling, the temperature is not equal to 15 °C, it will be necessary to determine the pressure corresponding to the temperature difference, in order to ensure that the maximum filling pressure allowed at a temperature of 15 °C is not exceeded. In order to check whether the tanks are filled beyond the maximum as set, select some tanks from among those filled, and measure their pressure

4. Pressurized gas tanks, where the maximum filling capacity is expressed in kg net weight (filling weight, admissible filling weight), must be filled based on weight (gravity filling). Containers should be weighed during filling. After filling, they should be placed on a special scale to avoid possible overfilling The control scales should be calibrated

5. Under certain conditions, gases with ct ≥ +70 °C can be transferred from a pressurized gas tank with a maximum capacity of 150 l to tanks with a maximum volumetric capacity of 1000 ccm

The filling of mechanics' liquid gas bottles must comply with the applicable technical regulations.

6. Vehicle reservoirs for:

(1) gases with ct ≥ +70 °C (See technical regulations 101 Annex 3)

(2) Technical mixture of gases with ct ≥ +70 °C (See technical regulations 102 Annex 1 Item 3) or

(3) liquid and cryogenic pressurized gases (see Technical Regulation 103), may be filled by volume (volumetric filling), contrary to the provisions of paragraph 4, as long as the filling system and/or the container are equipped with a device to measure and limit volume (except vehicle tanks, in accordance with paragraph 3) and to measure the filling temperature. When assessing by volume, make sure that the maximum filling weight, as shown on the tanks, is not exceeded. To check against possible overfilling, the weight-filled tanks are placed on a calibrated scale or, if the gases are not toxic, subjected to a volumetric assessment. To carry out a volumetric assessment, specific equipment is needed; the filling and checking equipment must be independent of each other.

7. Filling and checking measurements must be carried out by the same person. Control measurements should be carried out immediately after filling.

8. Overfilled tanks should immediately be emptied, until the correct filling amount is reached. Then, the amount of compressed gas introduced into the tank must be assessed again.

9. Paragraphs 4 to 7 do not apply to tanks with liquid and cryogenic pressurized gases that are neither combustible nor toxic; rules related to transport remain unchanged.

During filling of pressurized gas tanks with liquid gases, at filling temperatures ≤ -20 °C, the pressurized gas tank (when the substance in the tank is not checked at temperatures ≤ -20 °C) should only be removed from the filling device after its walls reach a temperature of ≥ +20 °C.

Regulation on recycling and disposal:

Control of the cooling agent:

According to the regulations on environmental statistics, a refrigerant gas test is compulsory.

All companies that belong to the automotive sector must inform the responsible authorities by means of statistics on the use of refrigerant gases. The amounts used during operation and maintenance must be duly registered (register book and/or refrigerant gas journal). See Volkswagen After Sales; ServiceNet; Volkswagen ServiceNet; Manuals; HSO (Service Organization Manual); Environment; Volume 2; Protection against emissions; Cooling agent from air conditioning systems / cooling agent oil). Records must be provided to competent authorities whenever requested

3.2 Regulations on recycling and disposal

Note

- *The following legislation and standards are in force in Germany; in other countries, the applicable legislation may be different or more comprehensive*
- *In other countries, the relevant information sources must be obtained from the competent authorities.*

Legislation on handling and disposal of cooling agents and cooling agent oils includes BIMISCH (Bundes- Immissionsschutzge-

setz - Federal law on emissions protection) and the regulations concern recycling and disposal.

3.3 Disposal of cooling agent and cooling machine oils

Refrigerant gas·

Cooling agents that are going to be disposed of should be placed in the appropriate recycling packaging, and the correct filling quantity should always be observed.

Refrigerant gas oils·

The air conditioning system oils used, coming from equipment with hydrocarbons, must be disposed of with great care and under the strictest surveillance. Mixing with other oils or substances is not allowed. Correct storage and disposal must comply with current legislation.

Information sources for technical regulations and occupational safety and accident prevention legislation in Germany:

Beuth-Verlag GmbH

Burggrafenstr. 6

10787 Berlin

Carl Heymanns Verlag KG

Luxemburger Str. 449

50674 Köln

Note

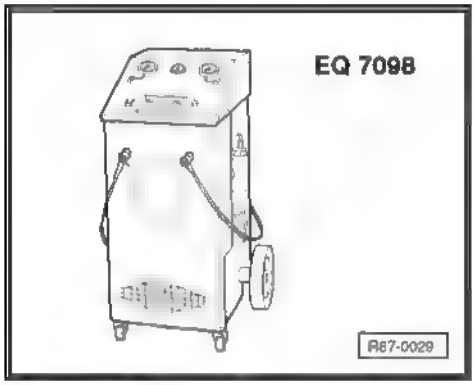
In other countries, the relevant information sources must be obtained from the competent authorities.

4 Using the climate control recovery, recycling, refilling, and cleaning equipment

Caution

- *If there is suspicion that chemicals to seal possible leaks have been attested in the refrigerant gas circuit, do not turn on the Climate control recovery, recycling and refill set - EQ 7098- and do not aspirate the refrigerant gas.*
- *The chemicals to seal leaks form deposits in the refrigerant circuit that harm the operation of the air conditioning and lead to its damage (and also to the Climate control recovery, recycling and refill set - EQ 7098-).*
- *When noticing that there are substances in the system that have not been approved by VW, warn the client and do not repair the system.*

4.1 Important notes for using the Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008-



Note

- *When using the climate control recovery, recycling, and refilling set or EQ 7098 - VAS 6008- , it is necessary to observe the following instructions (which also apply to other climate control recovery, recycling, refilling, and cleaning equipment).*
- *Other available test equipment and tools may also be used, please refer to ⇒ page 84 .*
- Work sequence: checking, sucking (recycling), emptying, filling, and cleaning must be carried out as described in the instruction manual of the respective equipment.
- Filters and separators should be replaced according to the specifications in the instruction manual (Always have a spare filter. In order to be assembled in compliance with the equipment manufacturer's instruction manual).
- Fill only with refrigerant oils approved for the specific cooling loop of the vehicle ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .

The refrigerant gas removed cannot be reused, even after cleaning the equipment, if the following conditions occur:

- In case of damage to the compressor entailing the decomposition of the refrigerant gas due to overheating.
- If the refrigerant gas circuit has dark, sticky sediments (the presence of these sediments can only be verified after opening the system).
- In case of doubt as to the composition of the refrigerant gas removed from the air conditioning loop.

In all these circumstances, replace the filter, dryer and refrigerant oil and clean the system, as required ➢ page 37 .

4.2 Connect the Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008-

Note

- *The working procedure may be subject to slight differences depending on which equipment is used. Therefore, it is necessary to observe the specific operating instructions for each equipment.*
- *Other available test equipment and tools may also be used, please refer to ⇒ page 84 .*

– Turn off the ignition and all electrical components.

– Connect the Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008- to the power supply.

– Loosen the service valve caps. (Refer to information on the specific refrigerant gas loops for each vehicle) ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .

– If necessary, remove any air from the flexible filling lines.

– Connect the flexible filling lines to the service valves.

Caution

Opening the quick couplings may cause damage to the air conditioning compressor or to the Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008- .

Opening the quick couplings with the engine running will cause a "short circuit" between the high and low pressure sides of the refrigerant gas loop. The engine cannot be started unless the quick couplings are closed.

4.3 Empty the refrigerant gas loop with the Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008-

Note

- *The working procedure may be subject to slight differences depending on which equipment is used. Therefore, it is necessary to observe the specific operating instructions for each equipment.*
- *Other available test equipment and tools may also be used, please refer to ⇒ page 84 .*

- The refrigerant gas loop must be emptied whenever it is necessary to disassemble certain components of the loop, if there are doubts as to the amount of refrigerant gas present in the circuit or if safety measures demand it.
- All notes related to the operation of the climate control recovery, recycling and refill set or EQ 7098 - VAS 6008- are included in the instructions manual for the respective equipment.

4.3.1 Sucking out the refrigerant gas

– Turn off the ignition and all electrical components.

– Connect the Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008- ⇒ page 37 .

– Activate the Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008- to suck out the refrigerant gas.

Note

- *During suction of the refrigerant gas, the oil present in the loop may also be sucked out. To ensure lubrication of the compressor, the refrigerant gas oil must be topped up. Refer to the specific repair manual for each vehicle ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .*
- *In vehicles equipped with an air conditioning compressor without Air conditioning magnetic coupling - N25- (with Adjustment valve for the air conditioning compressor - N280-) the engine may only run with the refrigerant gas loop empty for the amount of time that is strictly necessary, as the compressor will operate continuously. The engine speed must not exceed 2500 rpm. However, in vehicles equipped with an air conditioning compressor with Air conditioning magnetic coupling - N25- , this restriction does not apply, as the Air conditioning pressure switch - F129- or the High pressure sensor - G65- will check for the presence of refrigerant gas in the loop and switch off the Air conditioning magnetic coupler - N25- when the loop is empty.*
- *To avoid damage when the air conditioning compressor operates without an Air conditioning magnetic coupler - N25- (with Adjustment valve for the air conditioning compressor - N280-) with an empty refrigerant gas loop, the equipment has a device to make sure that oil is supplied. This means that approx. 40 to 50 cm^3 of refrigerant oil remains in the air conditioner compressor.*
- *Do not start the engine with the refrigerant circuit open.*

4.3.2 Remove the air from the refrigerant gas loop

• The refrigerant gas loop should be closed.

– Turn off the ignition and all electrical components.

– Connect the Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008- ⇒ page 37 .

– Activate the Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008- and begin the vacuum phase. The air is automatically removed from the refrigerant gas loop.

Once the vacuum phase is completed, the loop is checked for airtightness, and the vacuum, in bars, and number of seconds appear on the equipment display.

• If the vacuum is not maintained, proceed as follows:

– Detect leaks in the refrigerant gas loop ⇒ page 65 .

– After eliminating any leaks, once again remove the air from the refrigerant gas loop.

4.4 Fill the refrigerant gas loop with the Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008-

Note

- *The working procedure may be subject to slight differences depending on which equipment is used. Therefore, it is necessary to observe the specific operating instructions for each equipment.*
- *Other available test equipment and tools may also be used, please refer to* ⇒ page 84 .

- It is necessary to empty, that is, remove all air from the refrigerant gas loop, before filling it with refrigerant gas ⇒ page 37 .
- It is also necessary to remove all humidity from the loop if it has remained open for longer than would be required for normal assembly work.
- All notes related to the operation of the climate control recovery, recycling and refill set or EQ 7098 - VAS 6008- are included in the instructions manual for the respective equipment.

4.4.1 Filling refrigerant gas

– Turn off the ignition and all electrical components.
– Connect the Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008- ⇒ page 37 .
– Remove the air from the refrigerant gas loop ⇒ page 38 .
– After removing the air, start the Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008- and begin the filling phase (with refrigerant gas).
– After filling, turn on the air conditioning and check the pressure values ⇒ page 39 .

4.4.2 Activating the air conditioning after filling up the loop

Note

If the air conditioning compressor is removed, please turn the Poly-V belt by hand 10 turns before starting the engine. This action prevents the occurrence of damage caused by the oil surge in the compressor during the first activation of the air conditioning. To ensure lubrication of the compressor, the refrigerant gas oil must be topped up. Refer to the specific repair manual for each vehicle ⇒ Heating, air conditioning, Rep. gr. 87 ; Air conditioning

– Start the engine with the compressor turned off (Climatronic in "ECON" operation mode) and wait until the speed regime of idling speed stabilizes.
– Open the instrument panel bafflers.
– In the air conditioning temperature adjustment mechanism, select the lowest temperature (maximum cooling power).
– Turn on the air conditioning and idle the engine for at least 5 minutes.

– Check the pressure values in the refrigerant gas loop ⇒ page 42 .

– After checking the pressure, stop the engine and disconnect the Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008- .

4.5 Introduce refrigerant gas into the tank of the Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008-

Note

- *The working procedure may be subject to slight differences depending on which equipment is used. Therefore, it is necessary to observe the specific operating instructions for each equipment.*
- *Other available test equipment and tools may also be used, please refer to ⇒ page 84 .*

- Each type of air conditioning has a specific filling capacity for refrigerant gas. To ensure that the refrigerant gas filling capacity is the correct one (as both underfilling and overfilling have negative effects on the cooling power), the filling tank of the Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008- is equipped with a scale that indicates weight.

4.6 Emptying the tank of the Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008-

Note

- *The working procedure may be subject to slight differences depending on which equipment is used. Therefore, it is necessary to observe the specific operating instructions for each equipment.*
- *Emptying the tank of the Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008- is essential (for example, in order to suck out dirty refrigerant gas); always replace all filters and separators. Only remove the new filter and separator from their packaging immediately before assembly, in order to keep the humidity level as low as possible.*
- *Refrigerant gas tanks filled with dirty and used cooling gas are denominated "recycling tanks".*
- *Always empty recycling tanks before the first filling with refrigerant gas. Do not fill refrigerant gas tanks that contain air.*
- *The mixing of refrigerant gas or reuse of cooling gas mixtures is prohibited. If doubts remain as to the composition of the contents in the tank, the professional responsible for preparing the refrigerant gas should be informed.*

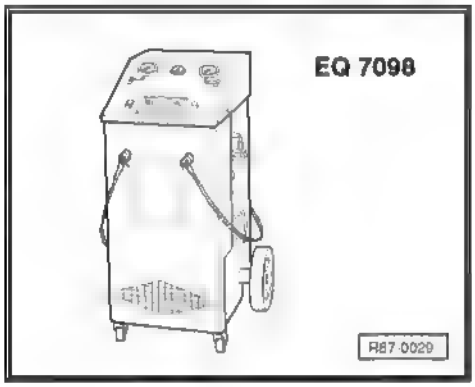
WARNING

- *During the filling of recycling tanks (pressurized tanks), observe the current standards, technical regulations and legislation.*
- *Overfilling of recycling tanks must be strictly avoided (very full recycling tanks have a very thin gas layer which is insufficient to permit the expansion of the liquid caused by thermal effect. The tanks may burst).*
- *For personal safety reasons, only use recycling tanks with an integrated safety valve.*
- *Recycling tanks must be weighed on a calibrated scale during filling. The maximum admissible filling capacity is 75% (filling factor of 0.75) of the filling weight indicated on the tank itself (do not rule out the possibility that refrigerant gas oil may also be present in the recycling tank).*

5 Checking pressure values in the refrigerant gas loop

Special tools and workshop equipment required

- Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008- .



Note

- *The working procedure may be subject to slight differences depending on which equipment is used. Therefore, it is necessary to observe the specific operating instructions for each equipment.*
- *Other available test equipment and tools may also be used, please refer to ⇒ page 84 .*
- *Check cooling power. The air conditioning is working properly if the air outlet from the instrument panel bafflers has a temperature equal or less than 7 °C when the system's lowest temperature is selected (maximum cooling power).*

Checking conditions:

- The radiator and the condenser are adequately clean (clean if necessary).
- The thermal insulation of the expansion valve is in order and properly assembled. Refer to the specific repair manual for each vehicle ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .
- The Poly-V belt of the air conditioning compressor is in order and properly tensioned.
- All air passages, covers and seals are in order and properly assembled.
- No fault is recorded in the fault memory. Consult the fault memory ⇒ Vehicle diagnostic tester.
- The dust and pollen filter is clean. Refer to the specific repair manual for each vehicle ⇒ Heating, air conditioning; Rep. gr 87 ; Air conditioning .
- The air conditioning device does not suck additional air when the fresh air fan operates at its highest speed
- The air conditioning device flaps, in the heat exchanger and in the evaporator, reach all the way to the stop. Refer to the specific repair manual for each vehicle ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .
- Water drainage from the evaporator is in order.
- The engine operates at normal operating temperature.

- The vehicle is not exposed to solar radiation.
- Ambient temperature above 15 °C.
- All the instrument panel bafflers are open.

5.1 Checking pressure values

– Turn off the ignition and all electrical components.

– Connect the Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008- ⇒ page 37 .

– Read the pressure gauges.

Pressures and temperatures recorded in the refrigerant gas loop vary depending on operational conditions (for example, engine speed, refrigerant liquid fan speed, engine temperature, compressor on or off) and on environmental factors (such as ambient temperature, humidity and requested cooling power).

In vehicles with Adjustment valve for the air conditioning compressor - N280- , the pressure on the low pressure side changes with the operation of the valve.

For this reason, the values in the table should only be considered as a reference. These values are reached after 20 minutes, at an engine speed of between 1,500 and 2,000 rpm and at ambient temperature of 20 °C.

Ambient temperature (in degrees Celsius)	Refrigerant gas circuit pressure in overpressure bar
+15 °C	3.9
+20 °C	4.7
+25 °C	5.6
+30 °C	6.7
+35 °C	7.8
+40 °C	9.1
+45 °C	10.5

Note

- *The temperature of the components of the refrigerant gas loop must be equal to the ambient temperature.*
- *If some assembly components of the refrigerant gas loop should be hotter or colder, the pressure will not match the values given in the table.*
- *When pressure is expressed as absolute pressure, 0 (zero) bar corresponds to an absolute vacuum. Normal atmospheric pressure (overpressure) is equal to 1 (one) bar of absolute pressure. On most pressure gauge scales, 0 (zero) bar equals 1 (one) bar of absolute pressure (identifiable by the indication (–1) below the (0)).*
- *In vehicles equipped with a High pressure sensor - G65- in which the pressure measured is indicated in the measurement values block, the value must match the values given in the table.*

If the pressure in the refrigerant gas loop is less than the value given in the table:

The amount of refrigerant gas in the loop is too small.

– Detect leaks in the refrigerant gas loop ➢ page 65 .

– Check the overpressure relief valve.

If the overpressure relief valve has released pressure:

– Check activation of the radiator fan
– Check the refrigerant gas lines for bottle necks and small twists.
– Check the refrigerant gas lines for external damage.
– If no fault is found, vent the refrigerant gas loop.

If the pressure in the refrigerant gas loop is equal to or greater than the value given in the table:

– Start the engine.
– In the air conditioning temperature adjustment mechanism, select the lowest temperature (maximum cooling power).

Note

If the low pressure switch has been disassembled in order to connect the Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008- , bridge the electric terminals of the respective connector.

- The air conditioning compressor is activated by the engine, via the Air conditioning magnetic coupler - N25- .
- The Adjustment valve for the air conditioning compressor - N280- is activated by the Climatronic control unit - J255- .

If the compressor or the adjustment valve do not operate with the engine running:

– Detect and eliminate the cause of the fault by checking, for example, the air conditioning fault memory ⇒ Vehicle diagnostic tester.
– Observe checking conditions ⇒ page 42 .
– Check the power supply to the Air conditioning magnetic coupler - N25- ; if it is in order, repair the Air conditioning magnetic coupler - N25- . Refer to the specific repair manual for each vehicle ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .
– Check the activation of the Adjustment valve for the air conditioning compressor - N280- .

Continuation of pressure value checking:

- Vehicles with butterfly (throttle) and collection tank (air conditioning compressor with internal adjustment device) ⇒ page 45 .
- Vehicles with expansion valve and liquid tank / dryer (air conditioning compressor with internal adjustment device) ⇒ page 48 .
- Vehicles with expansion valve, liquid tank / dryer and Adjustment valve for the air conditioning compressor - N280- (air conditioning compressor with external adjustment device) ⇒ page 52 .
- Vehicles with butterfly (throttle), collection tank and regulating valve for the air conditioning compressor - N280- (air conditioning compressor with external adjustment device) ⇒ page 60 .

5.2 Verification for vehicles with butterfly (throttle) and collection tank (air conditioning compressor with internal adjustment device)

Note

- *Connect the Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008- ⇒ page 37.*
- *Observe checking conditions ⇒ page 42 .*

– Start the engine and keep it running at a speed of 2,000 rpm.

– Observe the pressure gauges on the Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008- .

Note

- *The activating pressures for the refrigerant gas loop switches vary from vehicle to vehicle.*
- *The valve terminal of the low pressure switch or next to the evaporator should only be used in vehicles not equipped with a low pressure service terminal and in which the terminals of the air conditioning compressor or the collection tank are not accessible (measurement accuracy). Only applicable to certain vehicles.*

5.2.1 Nominal values

High pressure side:

Gradual rise from outlet pressure (at the time of connecting the pressure gauge) up to a maximum pressure of 20 bar.

Low pressure side:

Gradual fall of the outlet pressure (at the time of connecting the pressure gauge) to the value given in the diagram.

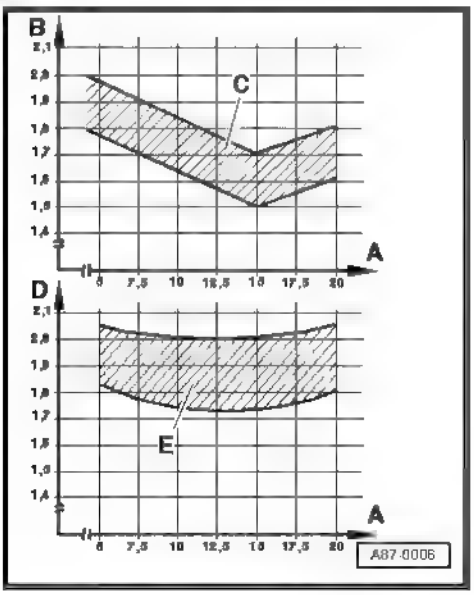
A - High pressure (measured at the service terminal), expressed in overpressure bar.

B - Low pressure (measured at the valve terminal next to the air conditioning compressor or collection tank), expressed in overpressure bar.

C - Admissible tolerance limit.

D - Low pressure (measured at the valve terminal next to the low pressure switch or the service terminal), expressed in overpressure bar.

E - Admissible tolerance limit.



Admissible deviation from the nominal value	Possible cause of the fault	Troubleshooting
• High pressure remains constant or rises only marginally above the value measured with the engine stopped • Low pressure decreases rapidly to the value given in the diagram or below it • The desired cooling power is not reached.	♦ The amount of refrigerant gas in the loop is too small.	– Suck refrigerant gas from the circuit ⇒ page 36 • The quantity of refrigerant gas removed is significantly less than the filling capacity indicated. – Locate and eliminate the leak ⇒ page 65 . – Refill the refrigerant gas loop ⇒ page 39 .
• High pressure is normal. • Low pressure matches the value given in the diagram. • The desired cooling power is not reached.		
• High pressure is normal. • Low pressure is very low (see diagram). • The desired cooling power is not reached.		

Note

If no fault is found, vent the refrigerant gas loop ⇒ page 70 .

Admissible deviation from the nominal value	Possible cause of the fault	Troubleshooting
• High pressure rises only marginally above the value measured with the engine stopped. • Low pressure decreases only marginally. • The desired cooling power is not reached.	♦ The air conditioning compressor is damaged.	– Wash the cooling refrigerant loop (clean) ⇒ page 72 . – Replace the air conditioning compressor.

Admissible deviation from the nominal value	Possible cause of the fault	Troubleshooting
• High pressure rises above the nominal value. • Low pressure decreases rapidly to the value given in the diagram or below it • The desired cooling power is not reached.	♦ Bottle neck or obstruction in the refrigerant gas loop	– Check manually whether the refrigerant gas has temperature gradients. • A temperature gradient was detected in one of the components – Replace the component if one of its rigid or flexible lines is either folded or bottle necked. – In case of obstruction, vent the refrigerant gas loop ⇒ page 70 . – Refill the refrigerant gas loop ⇒ page 39 . – Repeat the check. • No fault was detected: – Repeat the check.
• High and low pressure show normal values initially. • After some time, the high pressure rises above the nominal values. • Low pressure decreases rapidly to the value given in the diagram or below it. • The desired cooling power is not reached.	♦ Humidity in the refrigerant gas loop.	– Vent the refrigerant gas loop ⇒ page 70 . – Replace the collection tank. – Recheck in case of malfunction. – Refill the refrigerant gas loop ⇒ page 39 . – Repeat the check.
• High pressure is normal. • Low pressure is very low (see diagram). • The desired cooling power is not reached.	♦ The air conditioning compressor is damaged.	– Replace the air conditioning compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .

Note

♦ *If a fault is detected "with high pressure normal, low pressure very low", please observe the following:*

♦ *With this fault, the evaporator may freeze or the Air conditioning low pressure switch - F73 may turn off the air conditioning compressor even though the refrigerant gas amount contained in the loop is OK.*

Admissible deviation from the nominal value	Possible cause of the fault	Troubleshooting
• High pressure is normal or very high. • Low pressure is very high (see diagram). • The air conditioning compressor is noisy (especially after starting). • The desired cooling power is not reached.	♦ There is too much refrigerant gas in the loop.	– Suck the refrigerant gas from the loop ⇒ page 37 . • The quantity of refrigerant gas removed more or less matches the filling capacity indicated. – Replace the air conditioning compressor. • The quantity of refrigerant gas removed is significantly greater than the filling capacity indicated. – Refill the refrigerant gas loop ⇒ page 39 . – Repeat the check.

5.3 Verification for vehicles with expansion valve and liquid loop / dryer (air conditioning compressor with internal adjustment device)

Note

♦ *Connect the Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008- ⇒ page 37 .*

♦ *Observe checking conditions ⇒ page 42 .*

Start the engine and keep it running at a speed of 2,000 rpm.

– Read the pressure gauges of the climate control recovery, recycling, refilling, and cleaning equipment.

Note

♦ *The activating pressures for the refrigerant gas loop switches vary from vehicle to vehicle.*

♦ *The valve terminal of the low pressure switch or next to the evaporator should only be used in vehicles not equipped with a low pressure service terminal and in which the terminals of the air conditioning compressor or of the collection tank are not accessible (measuring accuracy). Only applicable to certain vehicles.*

5.3.1 Nominal values

High pressure side:

Gradual rise from outlet pressure (at the time of connecting the pressure gauge) up to a maximum pressure of 20 bar.

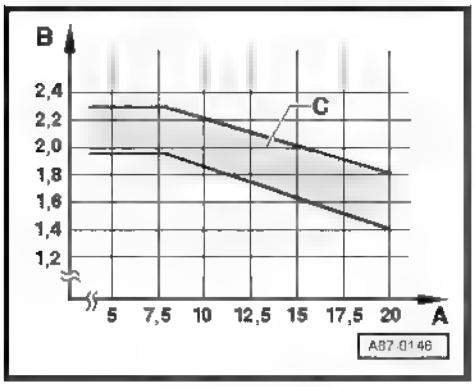
Low pressure side:

Gradual fall of the outlet pressure (at the time of connecting the pressure gauge) to the value given in the diagram.

A - High pressure, expressed in bar.

B - Low pressure, expressed in bar.

C - Admissible tolerance limit.



Admissible deviation from the nominal value	Possible cause of the fault	Troubleshooting
• High pressure remains constant or rises only marginally above the value measured with the engine stopped. • Low pressure decreases rapidly to the value given in the diagram or below it. • The desired cooling power is not reached.	♦ The amount of refrigerant gas in the loop is insufficient or the expansion valve is damaged.	– Suck the refrigerant gas from the loop ⇒ page 37 . • The quantity of refrigerant gas removed more or less matches the filling capacity indicated. – Replace the expansion valve. – Fill the refrigerant gas loop again. ⇒ page 39 . – Repeat the check.
• High pressure is normal. • Low pressure matches the value given in the diagram. • The desired cooling power is not reached.		• The quantity of refrigerant gas removed is significantly less than the filling capacity indicated. – Locate and eliminate the leak ⇒ page 65 . – Refill the refrigerant gas loop ⇒ page 39 . – Repeat the check.

Note

If no fault is detected and the operation of the air conditioning continues to present problems, vent the refrigerant gas loop ⇒ page 70 .

Admissible deviation from the nominal value	Possible cause of the fault	Troubleshooting
• High pressure rises above the nominal value. • Low pressure decreases rapidly to the value given in the diagram or below it. • The desired cooling power is not reached	♦ Bottle neck or obstruction in the refrigerant gas loop. ♦ The expansion valve is damaged.	– Check manually whether the refrigerant gas has temperature gradients. • A temperature gradient was detected in one of the components: – Replace the component if one of its rigid or flexible lines is either folded or bottle necked. – In case of obstruction, vent the refrigerant gas loop ⇒ page 70 . – Refill the refrigerant gas loop ⇒ page 39 . – Repeat the check. • No fault was detected. – Repeat the check.

Note

If, after washing the refrigerant gas loop, the air conditioning continues to malfunction, replace the expansion valve.

Admissible deviation from the nominal value	Possible cause of the fault	Troubleshooting
• High and low pressure show normal values initially. • After some time, the high pressure rises above the nominal values. • The low pressure decreases to the values given in the diagram or below it. • The desired cooling power is not reached.	♦ The expansion valve is damaged. ♦ Humidity in the refrigerant gas loop.	– Check the expansion valve and replace it if it shows signs of impurities or corrosion. – Vent the refrigerant circuit ⇒ page 70 . – Replace the liquid tank / dryer filter. – Recheck in case of malfunction. – Refill the refrigerant gas loop ⇒ page 39 . – Repeat the check.

Note

With this type of fault, it is usually necessary to replace the liquid tank / dryer filter.

Admissible deviation from the nominal value	Possible cause of the fault	Troubleshooting
• High pressure is normal or very high (see diagram). • The air conditioning compressor is noisy (especially after starting). • The desired cooling power is not reached.	♦ There is too much refrigerant gas in the loop. ♦ Either the expansion valve or the air conditioning compressor is damaged	– Suck the refrigerant gas from the loop ⇒ page 37 . • The quantity of refrigerant gas removed more or less matches the filling capacity indicated. – Replace the expansion valve. – Refill the refrigerant gas loop ⇒ page 39 . – Repeat the check. • The quantity of refrigerant gas removed is significantly greater than the filling capacity indicated. – Refill the refrigerant gas loop ⇒ page 39 . – Repeat the check.

Note

If the air conditioning continues to malfunction, after repeating the checking replace again the expansion valve and air the refrigerant gas loop. Then, replace the compressor and the liquid tank/dryer filter.

Admissible deviation from the nominal value	Possible cause of the fault	Troubleshooting
• High pressure rises only marginally above the value measured with the engine stopped. • Low pressure decreases only marginally. • The necessary cooling power is not reached.	♦ The air conditioning compressor is damaged.	– Replace the compressor and the liquid tank / dryer filter.
• High pressure is normal. • Low pressure is very low (see diagram). • The desired cooling power is not reached.	♦ Either the expansion valve or the air conditioning compressor is damaged.	– Replace the expansion valve. – Refill the refrigerant gas loop ⇒ page 39 . – Repeat the check.

Note

♦ *If during checking the air conditioning continues to malfunction, replace the compressor and the liquid tank / dryer filter*

♦ *In this type of fault, the evaporator may freeze even though there is an adequate amount of refrigerant gas in the refrigerant gas loop.*

Admissible deviation from the nominal value	Possible cause of the fault	Troubleshooting
• High and low pressure show normal values initially. • The air conditioning compressor is noisy (especially after starting). • The desired cooling power is not reached	♦ There is excess refrigerant gas oil in the loop	– Suck the refrigerant gas from the loop ⇒ page 37 .

Note

Excessive filling of refrigerant gas oil may occur, for example, when the compressor is replaced without correcting the amount of refrigerant gas oil.

5.4 Verification for vehicles with expansion valve, liquid tank / dryer and Adjustment valve for the air conditioning compressor - N280- (with air conditioning compressor with external adjustment device)

Note

♦ *Connect the climate control recovery, recycling, refilling, and cleaning equipment* ⇒ page 37 .

♦ *Observe checking conditions* ⇒ page 42 .

– Start the engine and keep it running at a speed of 2,000 rpm.

– Read the pressure gauges of the climate control recovery, recycling, refilling, and cleaning equipment.

Note

♦ *The activating pressures for the refrigerant gas loop switches vary from vehicle to vehicle.*

♦ *The valve terminal of the low pressure switch or next to the evaporator should only be used in vehicles not equipped with a low pressure service terminal and in which the terminals of the air conditioning compressor or of the collection tank are not accessible (measuring accuracy). Only applicable to certain vehicles.*

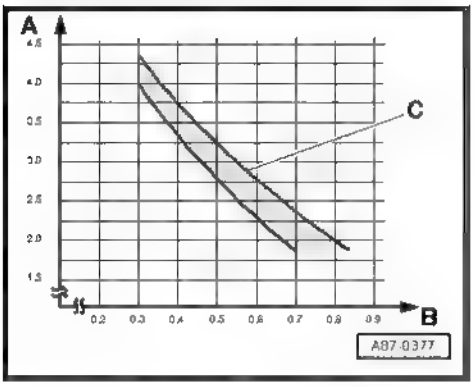
5.4.1 Nominal values

High pressure side:

Gradual rise from outlet pressure (at the time of connecting the pressure gauge) up to a maximum pressure of 20 bar.

Low pressure side:

Gradual fall of the outlet pressure (at the time of connecting the pressure gauge) to the value given in the diagram.



A - Low pressure (measured at the service terminal), expressed in absolute pressure bar

B - Control current of the Adjustment valve for the air conditioning compressor - N280- .

C - Admissible tolerance limit.

Note

- *The pressure measured in the high pressure side may, under adverse circumstances (extremely high ambient temperature and humidity), rise to almost 29 bar.*
- *Control current -B- is shown in the measurement values block.*
- *The high pressure measured by the High pressure sensor - G65- is indicated in the measurement values block ⇒ Vehicle diagnostic tester.*
- *The low pressure is automatically adjusted to a value within the tolerance limits, based on the control current of the Adjustment valve for the air conditioning compressor - N280- , within the power limits of the compressor.*
- *Under adverse conditions (extremely high ambient temperature and humidity), compressor power may not always be sufficient to reach the given value.*
- *The effective nominal current of the adjustment valve must be greater than 0.3 A to ensure its correct activation.*
- *For maximum cooling power, the control current is adjusted to values between 0.65 and 0.8 A (it varies from vehicle to vehicle and is indicated in the measurement values block).*
- *When pressure is expressed as absolute pressure, 0 (zero) bar corresponds to an absolute vacuum. Normal atmospheric pressure is equal to 1 (one) bar of absolute pressure. On most pressure gauge scales, 0 (zero) bar equals 1 (one) bar of absolute pressure (identifiable by the indication (–1) below the (0)).*

Admissible deviation from the nominal value	Possible cause of the fault	Troubleshooting
• High pressure remains constant or rises only marginally above the value measured with the engine stopped. • Low pressure decreases rapidly to the value given in the diagram or below it. • The desired cooling power is not reached.	♦ Activation of the Adjustment valve for the damaged air conditioning compressor - N280- . ♦ The amount of refrigerant gas in the loop is too small.	– Check activation of the Adjustment valve for the air conditioning compressor - N280- . – Locate and eliminate the leak ⇒ page 65 . – Refill the refrigerant gas loop ⇒ page 39 .
• High pressure is normal. • Low pressure matches the value given in the diagram. • The desired cooling power is not reached.		

Admissible deviation from the nominal value	Possible cause of the fault	Troubleshooting
• High pressure is normal • Low pressure is very low (see diagram). • The desired cooling power is not reached.	♦ The amount of refrigerant gas in the loop is too small.	– Suck the refrigerant gas from the loop ⇒ page 37 . • The quantity of refrigerant gas removed is significantly less than the filling capacity indicated. – Locate and eliminate the leak ⇒ page 65 . – Refill the refrigerant gas loop ⇒ page 39 . – Repeat the check. • The quantity of refrigerant gas removed more or less matches the filling capacity indicated.
	♦ The expansion valve is damaged.	– Replace the expansion valve. – Refill the refrigerant gas loop ⇒ page 39 . – Repeat the check.

Note

- *If no fault is found, vent the refrigerant gas loop ⇒ page 70 .*
- *Check measurement values for the Air outlet temperature sensor for the evaporator - G263- and operation of the Adjustment valve for the air conditioning compressor - N280- . If the measurement value for the High pressure sensor - G65- is incorrect, the evaporator may freeze or the cooling power is not be reached.*
- *If the air conditioning continues to malfunction, after repeating the check, replace the expansion valve again and vent the refrigerant gas loop. Then, replace the compressor and the liquid tank/dryer filter.*
- *In this type of fault, the evaporator may freeze even though there is an adequate amount of refrigerant gas in the refrigerant gas loop.*
- *If the expansion valve is faulty (permanently closed or only partly open), the Adjustment valve for the air conditioning compressor - N280- is adjusted for maximum power and the low pressure decreases to the value given in the diagram or below it (the air conditioning compressor sucks the refrigerant gas from the low pressure side). Since the refrigerant gas cannot pass through the expansion valve, the cooling power is not reached and the high pressure may not rise or rise only marginally, as there is no energy transformation.*

Admissible deviation from the nominal value	Possible cause of the fault	Troubleshooting
• High pressure rises only marginally above the value measured with the engine stopped. • Low pressure decreases only marginally. • The desired cooling power is not reached.	♦ Activation of the Adjustment valve for the damaged air conditioning compressor - N280- .	– Check activation of the Adjustment valve for the air conditioning compressor - N280- .
	♦ The air conditioning compressor is damaged.	– Replace the air conditioning compressor.
• High pressure rises above the nominal value. • Low pressure decreases rapidly to the value given in the diagram or below it. • The desired cooling power is not reached.	♦ Activation of the Adjustment valve for the damaged air conditioning compressor - N280- .	– Check activation of the Adjustment valve for the air conditioning compressor - N280- .
	♦ Bottle neck or obstruction in the refrigerant gas loop.	– Check manually whether the refrigerant gas has temperature gradients. • A temperature gradient was detected in one of the components: – Replace the component if one of its rigid or flexible lines is either folded or bottle necked. – In case of obstruction, vent the refrigerant gas loop ⇒ page 70 . – Refill the refrigerant gas loop ⇒ page 39 . – Repeat the check. • No fault was detected: – Refill the refrigerant gas loop ⇒ page 39 . – Recheck in case of malfunction.
	♦ The expansion valve is damaged.	– Suck the refrigerant gas from the loop ⇒ page 37 . – Replace the expansion valve and the liquid tank / dryer filter. – Refill the refrigerant gas loop ⇒ page 39 .

Note

- *In this type of fault, the evaporator may freeze even though there is an adequate amount of refrigerant gas in the refrigerant gas loop*
- *If the expansion valve is damaged (permanently closed or only partly open), the Adjustment valve for the air conditioning compressor - N280- is adjusted for maximum power and the low pressure decreases to the value given in the diagram or below (the air conditioning compressor sucks the refrigerant gas from the low pressure side). Since the refrigerant gas cannot pass through the expansion valve, the cooling power is not reached and the high pressure may not rise or rise only marginally, as there is no energy transformation.*

Admissible deviation from the nominal value	Possible cause of the fault	Troubleshooting
• High and low pressure show normal values initially. • After some time, the high pressure rises above the nominal values. • The low pressure decreases to the values given in the diagram or below it. • The desired cooling power is no longer reached.	♦ Activation of the Adjustment valve for the damaged air conditioning compressor - N280- .	– Check activation of the Adjustment valve for the air conditioning compressor - N280- .
• High and low pressure are initially normal. • After some time, the low pressure decreases to values below normal (the evaporator freezes). • After some time, the low pressure decreases to values below normal (the evaporator freezes).	♦ Humidity in the refrigerant gas loop	– Suck the refrigerant gas from the loop ⇒ page 37 . – Vent the refrigerant gas loop ⇒ page 70 . – Replace the liquid tank / dryer filter. – Remove the air from the refrigerant gas loop over at least 3 hours. – Refill the refrigerant gas loop ⇒ page 39 . – Recheck in case of malfunction. – Refill the refrigerant gas loop ⇒ page 39 . – Repeat the check.

Note

- *If the fault only appears after an extended period of operation or sporadically (the low pressure decreases to values lower than the nominal value and the evaporator freezes), only the dryer filter will need to be replaced. Correct the amount of refrigerant gas oil. Then, remove the air from the refrigerant gas loop over at least 3 hours.*
- *With this type of fault, it is not necessary to vent the refrigerant gas loop, as the amount of humidity in the system is minimal. Humidity may be extracted by means of a longer draining procedure.*
- *In this type of fault, the evaporator may freeze even though there is an adequate amount of refrigerant gas in the refrigerant gas loop.*

Admissible deviation from the nominal value	Possible cause of the fault	Troubleshooting
• High pressure is normal. • Low pressure is very low (see diagram). • The desired cooling power is not reached.	♦ Activation of the Adjustment valve for the damaged air conditioning compressor - N280- .	– Check activation of the Adjustment valve for the air conditioning compressor - N280- .
	♦ The expansion valve is damaged.	– Suck the refrigerant gas from the loop ⇒ page 37 . – Replace the expansion valve and the liquid tank / dryer filter. – Refill the refrigerant gas loop ⇒ page 39 . – Recheck in case of malfunction. – Replace the air conditioning compressor.
	♦ The air conditioning compressor is damaged.	– Suck the refrigerant gas from the loop ⇒ page 37 . – Replace the air conditioning compressor. – Refill the refrigerant gas loop ⇒ page 39 . – Repeat the check.

Note

- *If a fault is detected "with high pressure normal, low pressure very low", please observe the following:*
- *With this fault, the evaporator may freeze even though there is an adequate amount of refrigerant gas present in the refrigerant gas loop.*
- *Check measurement values for the Air outlet temperature sensor for the evaporator - G263- and operation of the Adjustment valve for the air conditioning compressor - N280- . If the measurement value for the High pressure sensor - G65- is incorrect, the evaporator may freeze or the cooling power is not be reached.*
- *If the fault is located in the Adjustment valve for the air conditioning compressor - N280- (the adjustment valve does not operate but the compressor continues to run), it is not necessary to vent the refrigerant gas loop. In this type of fault only the air conditioning compressor needs to be replaced (correct the amount of refrigerant gas oil in the new air conditioning compressor).*
- *If the expansion valve is faulty (permanently closed or only partly open), the Adjustment valve for the air conditioning compressor - N280- is adjusted for maximum power and the low pressure decreases to the value given in the diagram or below it (the air conditioning compressor sucks the refrigerant gas from the low pressure side). Since the refrigerant gas cannot pass through the expansion valve, the cooling power is not reached and the high pressure may not rise or rise only marginally, as there is no energy transformation.*

Admissible deviation from the nominal value	Possible cause of the fault	Troubleshooting
• High pressure is normal or very high. • Low pressure is very high (see diagram). • The air conditioning compressor is noisy (especially after starting). • The desired cooling power is not reached.	♦ Activation of the Adjustment valve for the damaged air conditioning compressor - N280- . ♦ There is excess refrigerant gas in the loop.	– Check activation of the Adjustment valve for the air conditioning compressor - N280- . – Suck the refrigerant gas from the loop ⇒ page 37 . • The quantity of refrigerant gas removed more or less matches the filling capacity indicated: – Replace the air conditioning compressor. • The quantity of refrigerant gas removed is significantly greater than the filling capacity indicated. – Refill the refrigerant gas loop ⇒ page 39 . – Repeat the check.

Admissible deviation from the nominal value	Possible cause of the fault	Troubleshooting
	♦ There is excess refrigerant gas oil in the loop.	– Suck the refrigerant gas from the loop ⇒ page 37 . • The quantity of refrigerant gas removed more or less matches the filling capacity indicated. – Refill the refrigerant gas loop ⇒ page 39 . – Repeat the check.
	♦ The expansion valve is damaged.	– Suck the refrigerant gas from the loop ⇒ page 37 . – Replace the expansion valve and the liquid tank / dryer filter. – Refill the refrigerant gas loop ⇒ page 39 . – Recheck in case of malfunction. – Replace the air conditioning compressor.
	♦ The air conditioning compressor is damaged.	– Suck the refrigerant gas from the loop ⇒ page 37 . – Replace the air conditioning compressor. • The quantity of refrigerant gas removed is significantly greater than the filling capacity indicated. – Refill the refrigerant gas loop ⇒ page 39 . – Repeat the check.

Note

- *If the fault is located in the Adjustment valve for the air conditioning compressor - N280- (the adjustment valve does not operate but the compressor continues to run), it is not necessary to vent the refrigerant gas loop. In this type of fault only the air conditioning compressor needs to be replaced (correct the amount of refrigerant gas oil in the new air conditioning compressor).*
- *If the expansion valve is faulty (permanently closed or only partly open), the Adjustment valve for the air conditioning compressor - N280- is adjusted for maximum power and the low pressure decreases to the value given in the diagram or below it (the air conditioning compressor sucks the refrigerant gas from the low pressure side). Since the refrigerant gas cannot pass through the expansion valve, the cooling power is not reached and the high pressure may not rise or rise only marginally, as there is no energy transformation.*

Admissible deviation from the nominal value	Possible cause of the fault	Troubleshooting
• High and low pressure show normal values. • The desired cooling power is not reached	♦ Activation of the Adjustment valve for the damaged air conditioning compressor - N280- . ♦ There is excess refrigerant gas oil in the loop.	– Check activation of the Adjustment valve for the air conditioning compressor - N280- .
• High and low pressure show normal values. • The air conditioning compressor is noisy (especially after starting). • The desired cooling power is not reached.	♦ There is excess refrigerant gas oil in the loop.	– Suck the refrigerant gas from the loop ⇒ page 37 . – Refill the refrigerant gas loop ⇒ page 39 . – Repeat the check.
	♦ The expansion valve is damaged.	– Replace the expansion valve.

Note

- *Excessive filling of refrigerant gas oil may occur, for example, when the compressor is replaced without correcting the amount of refrigerant gas oil.*
- *If the expansion valve is damaged (always open), the temperature in the evaporator is not regulated in order to ensure that the refrigerant gas comes out of the evaporator in gaseous form. Under certain operating conditions, the compressor may suck in liquid drops, causing noise (liquid cannot be condensed).*

5.5 Verification for vehicles with butterfly (throttle), collection tank and regulating valve for the air conditioning compressor - N280- (with air conditioning compressor with external adjustment device)

Note

- *Connect the climate control recovery, recycling, refilling, and cleaning equipment ⇒ page 37 .*
- *Observe checking conditions ⇒ page 42 .*

– Start the engine and keep it running at a speed of 2,000 rpm.

– Observe the pressure gauges on the Climate control recovery, recycling and refill set or EQ 7098 - VAS 6008- .

Note

- *The operating pressures of the Adjustment valve for the air conditioning compressor - N280- and of the Radiator fan - V7- vary from vehicle to vehicle.*
- *The valve terminal of the low pressure switch or next to the evaporator should only be used in vehicles not equipped with a low pressure service terminal and in which the terminals of the air conditioning compressor or of the collection tank are not accessible (measuring accuracy). Only applicable to certain vehicles*

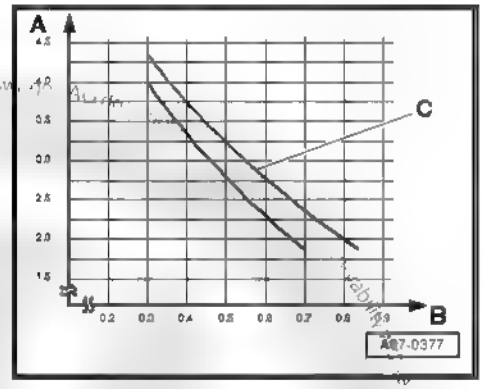
5.5.1 Nominal values

High pressure side:

Gradual rise from outlet pressure (at the time of connecting the pressure gauge) up to a maximum pressure of 20 bar.

Low pressure side:

Gradual fall of the outlet pressure (at the time of connecting the pressure gauge) to the value given in the diagram.



A - Low pressure (measured at the service terminal), expressed in absolute pressure bar.

B - Control current of the Adjustment valve for the air conditioning compressor - N280- .

C - Admissible tolerance limit.

Note

- *The pressure in the high pressure side may, under adverse circumstances (extremely high ambient temperature and humidity), rise to almost 29 bar.*
- *Control current -B- is shown in the measurement values block.*
- *The high pressure measured by the High pressure sensor - G65- is indicated in the measurement values block ⇒ Vehicle diagnostic tester.*
- *The low pressure is automatically adjusted to a value within the tolerance limits, based on the control current of the Adjustment valve for the air conditioning compressor - N280- , within the power limits of the compressor.*
- *Under adverse conditions (extremely high ambient temperature and humidity), compressor power may not always be sufficient to reach the given value.*
- *The effective nominal current of the adjustment valve must be greater than 0.3 A to ensure its correct activation.*
- *For maximum cooling power, the control current is adjusted to values between 0.65 and 0.8 A (it varies from vehicle to vehicle and is indicated in the measurement values block).*
- *When pressure is expressed as absolute pressure, 0 (zero) bar corresponds to an absolute vacuum. Normal atmospheric pressure is equal to 1 (one) bar of absolute pressure. On most pressure gauge scales, 0 (zero) bar equals 1 (one) bar of absolute pressure (identifiable by the indication (–1) below the (0)).*

Admissible deviation from the nominal value	Possible cause of the fault	Troubleshooting
• High pressure remains constant or rises only marginally (above the value measured with the engine stopped). • Low pressure decreases rapidly to the value given in the diagram or below it • The desired cooling power is not reached.	♦ Activation of the Adjustment valve for the damaged air conditioning compressor - N280- . ♦ The amount of refrigerant gas in the loop is too small.	– Check operation of the Adjustment valve for the air conditioning compressor - N280- . – Suck the refrigerant gas from the loop ⇒ page 37 . • The quantity of refrigerant gas removed is significantly less than the filling capacity indicated. – Locate and eliminate the leak ⇒ page 65 . – Refill the refrigerant gas loop ⇒ page 39 .
• High pressure is normal. • Low pressure matches the value given in the diagram. • The desired cooling power is not reached.		
• High pressure is normal. • Low pressure is very low (see diagram). • The desired cooling power is not reached.	♦ The amount of refrigerant gas in the loop is too small.	– Suck the refrigerant gas from the loop ⇒ page 37 . • The quantity of refrigerant gas removed is significantly less than the filling capacity indicated. – Locate and eliminate the leak ⇒ page 65 . – Refill the refrigerant gas loop ⇒ page 39 . – Repeat the check.

Note

If no damage is found, vent the refrigerant circuit ⇒ page 70 .

Admissible deviation from the nominal value	Possible cause of the fault	Troubleshooting
• High pressure rises only marginally above the value measured with the engine stopped. • Low pressure decreases only marginally. • The desired cooling power is not reached	♦ Activation of the Adjustment valve for the damaged air conditioning compressor - N280- .	– Check activation of the Adjustment valve for the air conditioning compressor - N280- .
	♦ The air conditioning compressor is damaged.	– Replace the air conditioning compressor

Admissible deviation from the nominal value	Possible cause of the fault	Troubleshooting
• High pressure rises above the nominal value. • Low pressure decreases only marginally. • The desired cooling power is not reached.	♦ Bottle neck or obstruction in the refrigerant gas loop.	– Check manually whether the refrigerant gas has temperature gradients. • A temperature gradient was detected in one of the components. – Replace the component if one of its rigid or flexible lines is either folded or bottle necked. – In case of obstruction, vent the refrigerant gas loop ⇒ page 70 . – Refill the refrigerant gas loop ⇒ page 39 . – Repeat the check. • No fault was detected:
• High and low pressure show normal values initially. • After some time, the high pressure rises above the nominal values. • The low pressure decreases rapidly to the values given in the diagram or below them. • The desired cooling power is not reached.	♦ Humidity in the refrigerant gas loop.	– Vent the refrigerant gas loop ⇒ page 70 . – Replace the collection tank. – Recheck in case of malfunction. – Refill the refrigerant gas loop ⇒ page 39 . – Repeat the check.
• High pressure is normal. • Low pressure is very low (see diagram). • The desired cooling power is not reached.	♦ Activation of the Adjustment valve for the damaged air conditioning compressor - N280- .	– Check operation of the Adjustment valve for the air conditioning compressor - N280- .
	♦ The air conditioning compressor is damaged.	– Replace the air conditioning compressor.

Note

♦ *If a fault is detected "with high pressure normal, low pressure very low", please observe the following:*

♦ *With this fault, the evaporator may freeze even though there is an adequate amount of refrigerant gas present in the refrigerant gas loop.*

♦ *Check measurement values for the Air outlet temperature sensor for the evaporator - G263- .*

♦ *Check activation of the Adjustment valve for the air conditioning compressor - N280- .*

Admissible deviation from the nominal value	Possible cause of the fault	Troubleshooting
• High pressure is normal or very high. • Low pressure is very high (see diagram). • The air conditioning compressor is noisy (especially after starting). • The desired cooling power is not reached.	♦ There is excess refrigerant gas in the loop.	– Suck the refrigerant gas from the loop ⇒ page 37 . • The quantity of refrigerant gas removed more or less matches the filling capacity indicated: – Replace the air conditioning compressor. • The quantity of refrigerant gas removed is significantly greater than the filling capacity indicated. – Refill the refrigerant gas loop ⇒ page 39 . – Repeat the check.
• High and low pressure show normal values initially. • The air conditioning compressor is noisy (especially after starting). • The desired cooling power is not reached.	♦ There is excess refrigerant gas oil in the loop.	– Suck the refrigerant gas from the loop ⇒ page 37 . – Refill the refrigerant gas loop ⇒ page 39 .

Note

Excessive filling of refrigerant gas oil may occur, for example, when the compressor is replaced without correcting the amount of refrigerant gas oil.

6 Detecting leaks in the refrigerant gas loop

Note

- *In this Repair Manual, the detection of leaks in the refrigerant gas circuit is described though different processes. These processes have been tested and lead to safe results in the several use conditions, when applied correctly and oriented by the complaint.*
- *The small leaks can be detected, for instance, with an electronic device to detect leaks or with a lamp to detect leaks*
- *There is a number of leak detection processes of the refrigerant gas circuit in the market. These processes do not always offer clear results. If the process is not followed to the letter, there are components in the refrigerant gas circuit that may be indicated as leaky, even though they have no leaks. Moreover, in some processes the components of the refrigerant gas circuit may be damaged.*
- *The components in which leak is detected cannot be repaired; they will have to be replaced by original parts.*

Caution

- *If there is suspicion that chemicals to seal possible leaks have been tested in the refrigerant gas circuit, do not turn on the Climate control recovery, recycling and refill set - EQ 7098- and do not aspirate the refrigerant gas.*
- *The chemicals to seal leaks form deposits in the refrigerant circuit that harm the operation of the air conditioning and lead to its damage (and also to the Climate control recovery, recycling and refill set - EQ 7098-).*
- *When noticing that there are substances in the system that have not been approved by VW, warn the client and do not repair the system.*

The refrigerant gas loop may have leaks due, for example, to external damage.

In case small leaks are detected, due to the extremely small quantity of refrigerant spilt, an electronic leak detector may be used.

Electronic leak detection devices can detect annual refrigerant gas losses of less than 5 grams. There are various devices of this type, specifically adapted to the composition of the respective refrigerant gases.

Note

Leak detection devices that are appropriate for R12 refrigerant gas do not work with R134a refrigerant gas, as the latter does not contain the chlorine atoms which would be detected by the R12 leak detectors.

Note

- *VW refuses to use chemicals to seal leaks in the refrigerant gas circuit.*
- *The chemicals used to seal leaks in the refrigerant gas circuit often react with the room air and with humidity in it. Due to the formation of deposits in the refrigerant gas circuit (and in the Climate control recovery, recycling and refill set - EQ 7098-), they cause anomalies in the valves and other components with which they come in contact. These deposits can never again be removed from the components (not even by washing).*
- *The chemicals used to seal the leaks in the refrigerant gas circuit cannot be normally identified from the outside. Thus, it is necessary to proceed with caution when dealing with a vehicle whose past is unknown.*

6.1 Detecting leaks in the refrigerant gas loop with the R134a air conditioning leak detector or EQ 7051 - VAG 1796-

Special tools and workshop equipment required

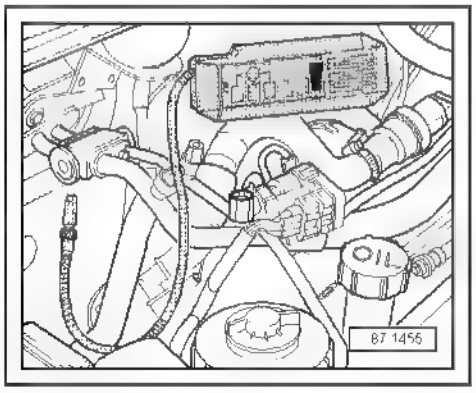
- R134a air conditioning leak detector - VAG 1796- .

Note

- *The refrigerant gas dissipates rapidly with air movement. Thus, avoid air currents during leak detection.*
- *If the refrigerant gas loop is completely empty, insert 100 grams of refrigerant gas.*

– Activate the R134a air conditioning leak detector or EQ 7051 - VAG 1796- according to the equipment instruction manual.
– Always keep the verification probe below the location of the expected leak.

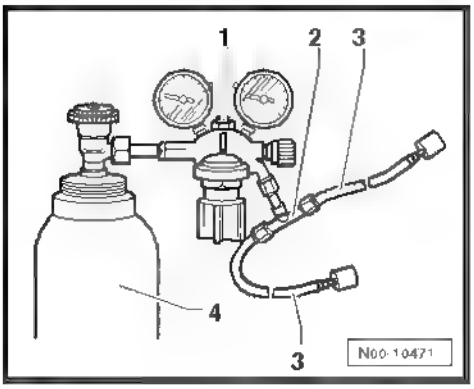
If the frequency of clicks increases or an alarm sounds, depending on the equipment model, a leak has been detected (see the equipment instruction manual).



6.2 Detecting leaks in the refrigerant gas loop by pressurizing the system

Special tools and workshop equipment required

- Pressure gauges with nitrogen pressure regulator (maximum pressure: 15 bar)



1 - Pressure gauges with pressure regulator

2 - T Connection

3 - Flexible pressure line (inner diameter 5 mm, length 2 m)

4 - Nitrogen bottle

> **WARNING**
>
> - *Nitrogen may escape from the tank in an uncontrolled manner.*
> - *Only use nitrogen pressure regulators (maximum pressure: 15 bar)*
> - *Suck the gas mixture coming out of the components, using the appropriate equipment.*

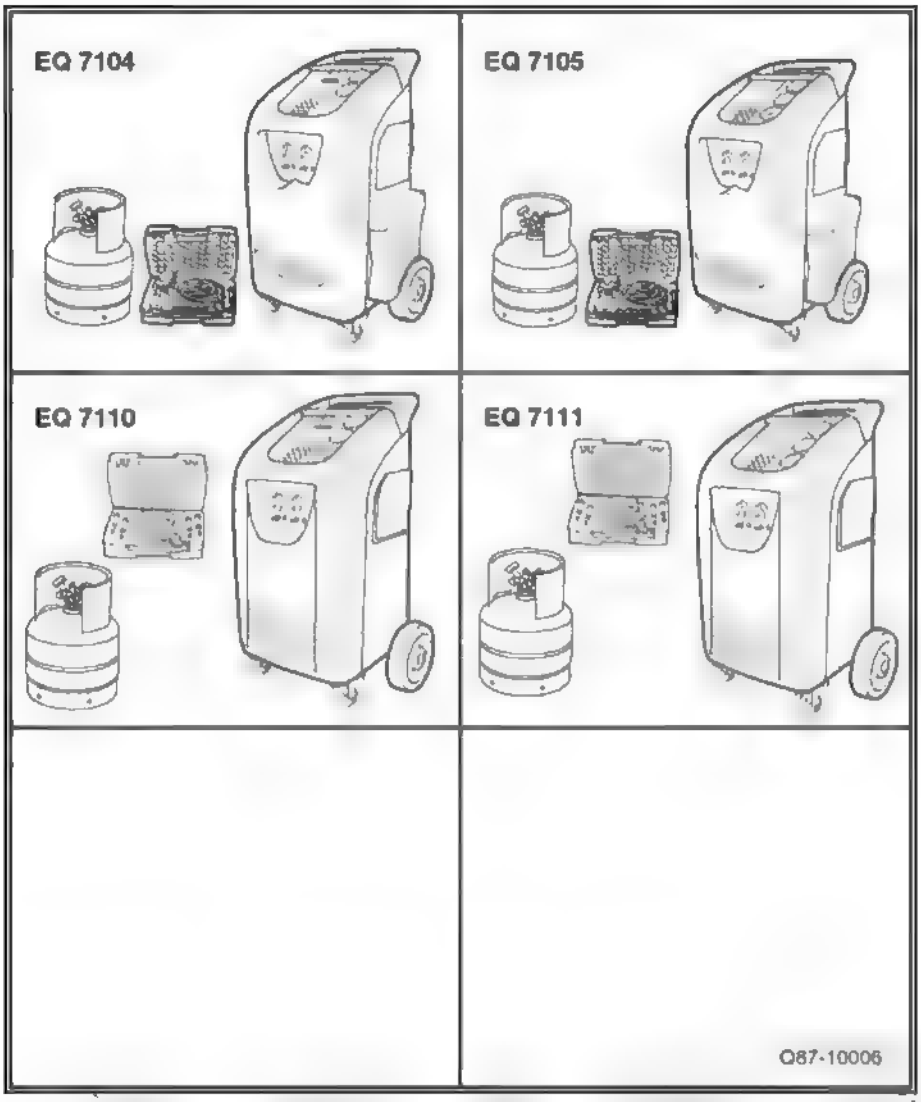
– Connect the Pressure gauges with nitrogen pressure regulator (maximum pressure: 15 bar) to the nitrogen bottle and to the high and low pressure flexible lines.

– Cover the refrigerant gas loop with soap solution.

Leaks will be identified by the soap bubbles.

6.3 Detection of leaks in the refrigerant gas loop with the air conditioning recovery, recycling, recharging and cleaning set

Special tools and workshop equipment required



- Climate control recovery, recycling, refilling, and cleaning set - EQ 7104-
- Climate control recovery, recycling, refilling, and cleaning set - EQ 7105-
- Climate control recovery, recycling, refilling, and cleaning set - EQ 7110-
- Climate control recovery, recycling, refilling, and cleaning set - EQ 7111-

Note

The working procedure may be subject to slight differences depending on which equipment is used. Therefore, it is necessary to observe the specific operating instructions for each equipment.

– Turn off the ignition and all electrical components.
– Connect and turn on the climate control recovery, recycling, refilling, and cleaning set according to the instruction manual.
– Loosen the service valve caps. (Refer to information on the specific refrigerant gas loops for each vehicle) ➢ Heating, air conditioning, Rep gr. 87 ; Air conditioning

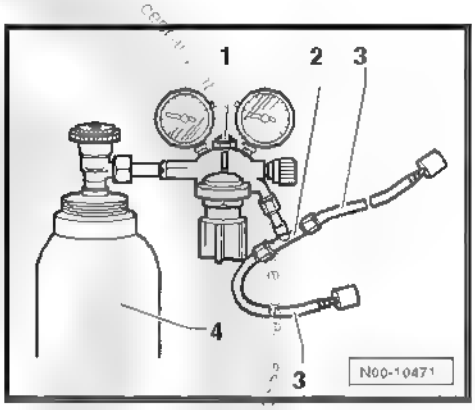
- If necessary, remove any air from the flexible filling lines.
- Connect the flexible filling lines to the service valves.
- Empty the refrigerant circuit ➔ page 37 .
- Select the system washing option in the climate control recovery, recycling, refilling, and cleaning set, and follow the desired functions according to the instruction manual.

7 Cleaning the refrigerant gas loop

7.1 Venting the refrigerant gas loop

Special tools and workshop equipment required

- Pressure gauges with nitrogen pressure regulator (maximum pressure: 15 bar)



1 - Pressure gauges with pressure regulator

2 - T Connection

3 - Flexible pressure line (inner diameter 5 mm, length 2m)

4 - Nitrogen bottle

- To remove humidity, impurity and old oil from the refrigerant gas loop, use compressed air and nitrogen.

Vent (blow) the refrigerant gas loop and some components if:

- There is no possibility of washing the refrigerant gas loop.
- Dirt and other impurities have accumulated in components of the refrigerant gas loop.
- The vacuum indication does not hold when air is removed from a refrigerant gas loop thought to be airtight (indicating the presence of humidity in the refrigerant gas loop, which increases pressure).
- The refrigerant gas loop has remained open for more time than would have been necessary for normal assembly work (for example, after an accident).
- Pressure and temperature measurement indicate that humidity is present in the refrigerant gas loop.
- There are doubts as to the filling capacity of refrigerant gas oil in the respective loop.
- It is necessary to replace the air conditioning compressor after an internal breakdown (for example, noise or low power), but only if there is no possibility of washing with R134a refrigerant gas .
- The specific repair manual for each vehicle requires this after replacing certain components ⇒ Heating, air conditioning, Rep gr. 87 ; Air conditioning .

Note

- *Venting the refrigerant gas circuit with compressed air and nitrogen does not achieve the same cleaning performance as washing it with R134a refrigerant gas.*
- *When venting (blowing), do not exceed the pressure of 15 bar (if necessary, also use a pressure reducer for the compressed air).*

WARNING

- *Nitrogen may escape from the tank in an uncontrolled manner.*
- *Only use nitrogen pressure regulators (maximum pressure: 15 bar)*
- *Suck the gas mixture coming out of the components, using the appropriate equipment.*

– Empty the refrigerant circuit ⇒ page 37 .

– Remove the air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .

In vehicles with butterfly (throttle) and collection tank:

– Remove the throttle (vehicle-specific) and rejoin the refrigerant gas lines using the adapters and the flexible filling line - VAS 6338/31- of the adapter case for R134a refrigerant gas loops for VW/Audi vehicles - VAS 6338/1- .

– Remove the collection tank (vehicle-specific) and rejoin the refrigerant gas lines using the adapters and the Flexible filling line - VAS 6338/31- of the Adapter case for R134a refrigerant gas loops for VW/Audi vehicles - VAS 6338/1- .

In vehicles with expansion valve and liquid tank / dryer:

– Remove the liquid tank (vehicle specific) and rejoin the refrigerant gas lines using the adapters and the Flexible filling line - VAS 6338/31- of the Adapter case for R134a refrigerant gas loops for VW/Audi vehicles - VAS 6338/1- or remove the dryer filter.

– Remove the expansion valve (vehicle specific) and rejoin the refrigerant gas lines using the adapters and the Flexible filling line - VAS 6338/31- of the Adapter case for R134a refrigerant gas loops for VW/Audi vehicles - VAS 6338/1- .

– Always vent (blow) the components against the direction of flow of the refrigerant gas.

Note

The compressed air and the nitrogen must not be blown into the butterfly (throttle), the expansion valve, the compressor or the liquid tank/dryer filter/collection tank.

– In condensers with integrated dryer, remove the filter.

– The evaporator should be aired with the expansion valve or the butterfly (throttle) removed, through the low pressure terminal (large diameter).

– Please remove oil and impurities from the refrigerant gas loop, using compressed air, and then dry the components with nitrogen.

To prevent oil or humidity from the compressed air system from entering the refrigerant gas loop, please observe the following:

- For cleaning and drying, the compressed air must flow through a compressed air cleaning equipment and a drying filter (supplied as a tool for paint works) ⇒ Special Tools and Workshop Equipment Catalogue .
- In vehicles in which an adapter cannot be used on the refrigerant gas lines, use a pistol with rubber nozzle. Take care not to damage the terminals (by compressing or scratching).

Note

- *The compressed air or nitrogen released by the components must be sucked out with appropriate equipment.*
- *Certain impurities found in old oil or refrigerant gas cannot be removed from the refrigerant gas loop with compressed air. These impurities can be removed by washing with R134a refrigerant gas* *⇒ page 72 .*
- *Check the expansion valve and replace it if it shows signs of impurities or corrosion.*
- *If components contain dark or sticky sediments, which cannot be removed with compressed air, replace them.*
- *Fine sediments of light grey colour on the inside of the refrigerant gas lines do not hinder the operation of the components.*
- *After venting, replace the liquid tank/dryer filter/collection tank filter and the butterfly (throttle).*

7.2 Washing the refrigerant gas loop with R134a refrigerant gas (clean)

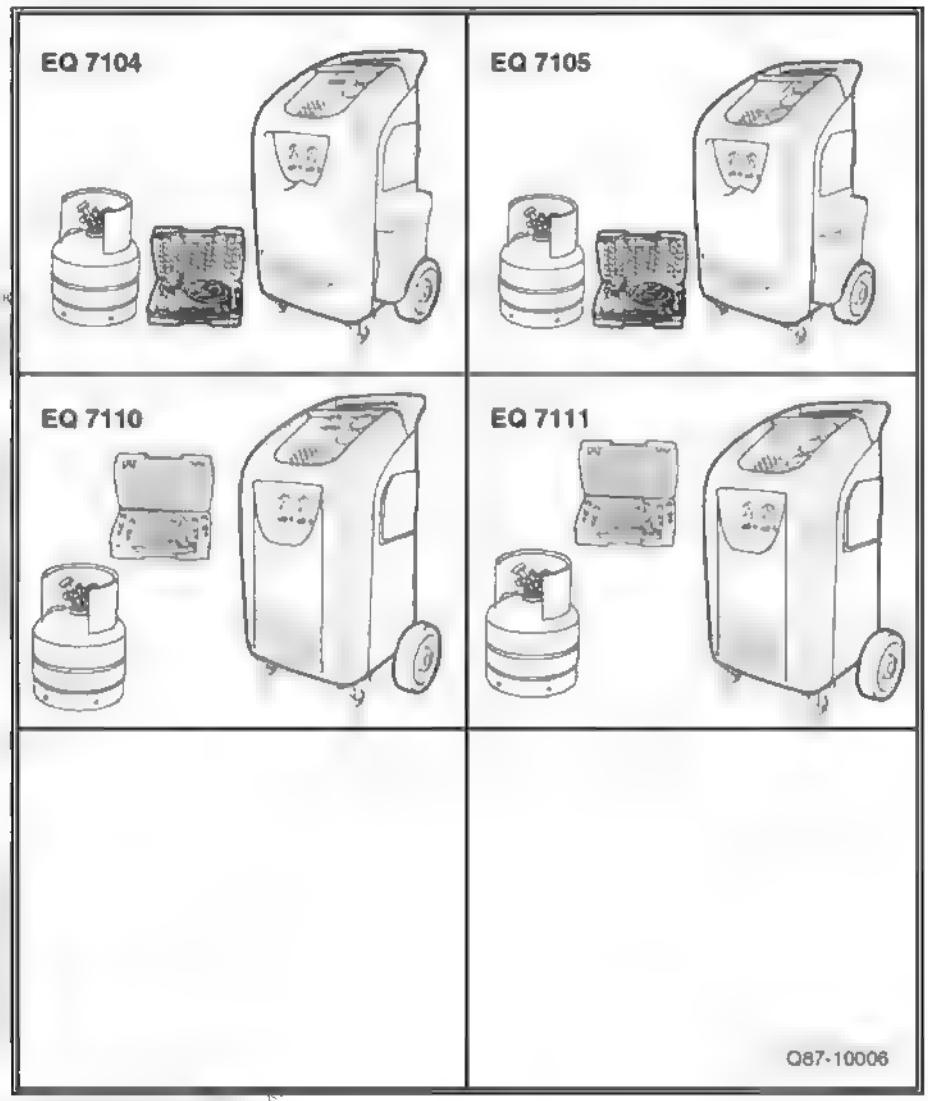
Caution

- *If there is suspicion that chemicals to seal possible leaks have been tested in the refrigerant gas circuit, do not turn on the Climate control recovery, recycling and refill set - EQ 7098- and do not aspirate the refrigerant gas.*
- *The chemicals to seal leaks form deposits in the refrigerant circuit that harm the operation of the air conditioning and lead to its damage (and also to the Climate control recovery, recycling and refill set - EQ 7098-).*
- *When noticing that there are substances in the system that have not been approved by VW, warn the client and do not repair the system.*

Note

- *VW refuses to use chemicals to seal leaks in the refrigerant gas circuit.*
- *The chemicals used to seal leaks in the refrigerant gas circuit often react with the room air and with humidity in it. Due to the formation of deposits in the refrigerant gas circuit (and in the Climate control recovery, recycling and refill set - EQ 7098-), they cause anomalies in the valves and other components with which they come in contact. These deposits can never again be removed from the components (not even by washing).*
- *The chemicals used to seal the leaks in the refrigerant gas circuit cannot be normally identified from the outside. Thus, it is necessary to proceed with caution when dealing with a vehicle whose past is unknown.*

Special tools and workshop equipment required



- Climate control recovery, recycling, refilling, and cleaning set - EQ 7104-
- Climate control recovery, recycling, refilling, and cleaning set - EQ 7105-

- Climate control recovery, recycling, refilling, and cleaning set - EQ 7110-
- Climate control recovery, recycling, refilling, and cleaning set - EQ 7111-

Note

The working procedure may be subject to slight differences depending on which equipment is used. Therefore, it is necessary to observe the specific operating instructions for each equipment.

- In order to remove the old oil and other impurities (e.g., chips from a damaged air conditioning compressor) from the refrigerant gas loop as easily and cleanly as possible, wash the refrigerant gas loop with refrigerant gas R134a.

Wash the refrigerant gas loop if:

- Dirt and other impurities have accumulated in components of the refrigerant gas loop.
- The vacuum indication does not hold when air is removed from a refrigerant gas loop thought to be airtight (indicating the presence of humidity in the refrigerant gas loop, which increases pressure).
- The refrigerant gas loop has remained open for more time than would have been necessary for normal assembly work (for example, after an accident).
- Pressure and temperature measurement indicate that humidity is present in the refrigerant gas loop.
- There are doubts as to the filling capacity of refrigerant gas oil in the respective loop.
- It is necessary to replace the air conditioning compressor after an internal breakdown (for example, noise or low power), but only if there is no possibility of washing with R134a refrigerant gas .
- The specific repair manual for each vehicle requires this after replacing certain components ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .

– Empty the refrigerant circuit ⇒ page 37 .
– Remove the air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .

In vehicles with butterfly (throttle) and collection tank:

– Remove the butterfly (throttle) and collection tank.

Note

Although the collection tank can be washed, due to its large volume, it requires a great volume of refrigerant gas. When this gas is sucked into the collection tank, it freezes, making the procedure much slower.

In vehicles with expansion valve and liquid tank / dryer.

– Remove the liquid tank (vehicle specific) and rejoin the refrigerant gas lines with the adapters or remove the drier filter
– Remove the expansion valve (vehicle-specific) and rejoin the refrigerant gas lines

- Check the amount of refrigerant gas in the tanks. There must be a minimum of 7 kg of R134a refrigerant gas
- Empty the used oil tank of the air conditioning system service station.
- Connect the flexible supply line (high pressure side) from the service station to an adapter on the low pressure lining of the air conditioning compressor (line with a larger diameter)
- Connect the flexible return line (low pressure or intake side) of the service station to the outlet of the refrigerant gas loop washing device.
- Connect the inlet of the refrigerant gas loop washing device to a high pressure lining connected to the air conditioning compressor (line with a smaller diameter).

Note

- *The components are washed in the direction opposite to that of the refrigerant gas flow.*
- *During washing, impurities are transferred from the refrigerant gas loop to the washing device and the air conditioning service station and are retained in the integrated filters on the station. Depending on the type of impurities and according to the equipment instruction manual, these components must be replaced at shorter intervals.*
- *The filter of the refrigerant gas loop washing device must be replaced after 5 to 10 washing cycles (depending on the impurity level of the refrigerant gas loops washed).*
- *Replace the filter after washing an extremely dirty refrigerant gas loop (refrigerant gas oil either black and viscous or with a great content of chips from the air conditioning compressor). Then, we recommend repeating the washing procedure.*
- *Depending on their type, impurities may build up on the display window of the refrigerant gas loop washing device. After washing, clean the display window and wash the refrigerant gas loop again.*
- *The butterfly (throttle), the expansion valve, and the liquid and collection tanks/dryer filter must be removed and replaced with adapters during washing, since the liquid refrigerant gas may not reach the required speed through these components.*

- Turn on the air conditioning service station and wash the refrigerant gas loop (a 3-pass washing cycle takes 1 to 1.5 hours).

Note

- *The washing procedure of a refrigerant gas loop should be carried out as described in the equipment manual.*
- *Depending on the version of the service station, the used oil tank has a capacity of approximately just 125 cm ^{3} of refrigerant gas. If a system with a great quantity of refrigerant gas oil is washed, it may be necessary to empty the used oil tank after the first washing cycle.*
- *Check the refrigerant gas coming out from the loop. The loop can be considered clean when the refrigerant gas is clear and colourless in the display window of the washing device*
- *During washing, the oil in the refrigerant gas loop is removed, and only a small, insignificant residual quantity remains in the evaporator.*
- *In case of excessive dirt, it may be necessary to repeat the washing cycle twice (two 3-pass washing cycles).*

Washing process sequence

Note

Depending on the version of the air conditioning service station, the washing sequence is carried out automatically.

- After start-up, the washing loop is emptied (refrigerant circuit with flexible connecting lines and washing device), in order to enable the system to be checked for tightness. Depending on the version of the air conditioning service station, it may be necessary to proceed with the washing procedure sequence manually.
- The empty washing loop is filled with a predefined refrigerant gas volume (e.g. 4 kg) through the high pressure side of the air conditioning service station (in the opposite direction of the normal refrigerant gas flow direction) and on the low pressure side of the vehicle's refrigerant gas loop. Depending on the version of the air conditioning service station, refrigerant gas is transferred to the washing loop until it is replenished. This condition can be perceived when e.g. after a certain period of time, the refrigerant gas stops flowing.
- Depending on the version of the air conditioning service station and the washing device, after the system is filled with the recommended volume of refrigerant gas, the heating, for example, of the washing device is turned on (only if the refrigerant gas comes out from the washing device in gaseous form).
- When the refrigerant gas is sucked out, the heating (if available) of the refrigerant circuit washing device is turned off The refrigerant circuit, depending on its version, may be emptied and, then, the refrigerant gas oil is removed through the air conditioning service station.
- The refrigerant gas filling, sucking and emptying procedure is repeated twice (i e. it is carried out three times)
- After the third aspiration, depending on the version of the air conditioning service station, the washing loop is emptied.

– After completing the washing cycle, check the display window of the refrigerant circuit washing device If it is dirty, clean the system according to the instruction manual of the washing device or the air conditioning service station and repeat the

washing cycle. One washing cycle is enough (duration: approximately 30 minutes).

- Check the pressure in the refrigerant circuit. There must not be overpressure in the loop (if necessary, empty the loop again) ⇒ page 42 .
- Disconnect the air conditioning service station from the refrigerant circuit and remove the adapters used.
- Replace the following components (specific to each vehicle):

♦ Butterfly (throttle) and collection tank

♦ Expansion valve and liquid tank/dryer filter

- Replace the compressor if it is damaged. Otherwise, drain the remaining refrigerant gas oil from inside the compressor and fill it with the recommended volume of oil specific to each vehicle ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .
- Fill the refrigerant circuit ⇒ page 39 .
- Activate the air conditioning ⇒ page 39 .

8 Problems

8.1 Possible problems in the refrigerant circuit

Note

The air conditioning is working properly if the air outlet from the instrument panel bafflers has a temperature equal or less than 7 °C when the system's lowest temperature is selected (maximum cooling power).

8.1.1 Checking conditions

- The air conditioning self-diagnosis did not detect any faults with the Diagnosis, Measurement and Information System - VAS 5051A /52- via "Assisted troubleshooting"; no condition is shown in the measurement values block that would explain the compressor cut-off (only for vehicles equipped with air conditioning self-diagnosis).

8.1.2 Possible problems

- Cooling fails completely.
- Cooling power is too weak regardless of vehicle speed or engine speed.
- Cooling is absent or insufficient after a few kilometres.
- The air conditioning compressor, the Air conditioning magnetic coupler - N25- or the Adjustment valve for the air conditioning compressor - N280- are switched off by the Low pressure switch for magnetic coupling - F73- , High pressure switch for magnetic coupling - F118- , Pressure switch for magnetic coupling - F129- or by the Air conditioning command and indicator unit / Climatronic - E87- or the Climatronic control unit - J255- in case of very high or very low pressure.
- There is no or little fresh air flow after travelling for a few kilometres (evaporator frozen).

In these cases, check the pressure values ⇒ page 42 .

In addition, the following problems may also occur:

The compressor is noisy:

– Tighten the compressor and compressor support securing bolts, using a Torque wrench - 5 to 50 Nm (1/2" drive) - VAG 1331- . Refer to the specific repair manual for each vehicle ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .

– Check the refrigerant gas lines; they must not touch other assembly components and must be installed tension-free (adjust them if necessary).

Noise appears right after the air conditioning is turned on and/or on curves or when braking:

– Empty the refrigerant circuit, remove air and fill it up again (excess of refrigerant gas in the loop) › page 37 .

Note

An excess of refrigerant gas oil may also lead to this situation

The air conditioning works perfectly, but water comes out of the bafflers (in the instrument panel or in the footwell):

- Check whether the evaporator water draining lines are correctly placed and that they are not pinched or bent.
- Check the water drainage valve, which must open and close correctly.
- Check the water box covering, which must not be damaged and should be properly installed (water must not enter the evaporator).
- Check the water drainage devices of the water box, which must not be closed (for example, obstructed by leaves).

9 Replacing components

- All components of the refrigerant circuit sent for quality evaluation should be properly closed (use the original plugs of the replacement part).
- Genuine replacement parts (air conditioning compressor, collection tank, liquid tank, evaporator and condenser) are filled with nitrogen. However, the gas gradually leaks out, causing the pressure to decrease to the point that when initially opening the component, no gas outflow is detected
- In vehicles equipped with an air conditioning compressor without Air conditioning magnetic coupling - N25- (with Adjustment valve for the air conditioning compressor - N280-) the engine should only run with the refrigerant circuit empty for the amount of time that is strictly necessary, as the compressor will operate continuously. The engine speed must not exceed 2500 rpm. However, in vehicles equipped with an air conditioning compressor with Air conditioning magnetic coupling - N25- , this restriction does not apply, as the Air conditioning pressure switch - F129- or the High pressure sensor - G65- will check for the presence of refrigerant gas in the loop and switch off the Air conditioning magnetic coupler - N25- when the loop is empty.
- To avoid damage when the air conditioning compressor operates without the Air conditioning magnetic coupler - N25- (with Adjustment valve for the air conditioning compressor - N280-) with an empty refrigerant circuit, the equipment is equipped with a device to ensure the oil supply. This means that 40 to 50 cm^3 of refrigerant oil remains in the air conditioning compressor.
- Do not start the engine with the refrigerant circuit open.

9.1 Leaking or damaged components (except the compressor, collection tank and liquid tank)

9.1.1 A completely empty refrigerant circuit

– Replace the damaged component.

– Remove the air conditioning compressor and drain the oil from it ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .

Note

To speed up the outflow of the refrigerant gas oil, turn the compressor shaft manually using the pulley or the Air conditioning magnetic coupler - N25- .

WARNING

To ensure compressor lubrication during activation, fill it with refrigerant gas oil "30% of the total quantity used by the system" in the compressor; the remaining oil must be distributed in the indicated proportions, according to ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning manual.

– Replace the liquid/collection tank and the butterfly (throttle) ➢ page 82 .

- Assemble the refrigerant circuit
- Remove any air and replenish the loop ⇒ page 39 .

9.1.2 The loop still contains refrigerant gas

- Empty the refrigerant circuit ⇒ page 37 .
- Replace the damaged component.
- Collect the refrigerant gas oil.
- Introduce the same quantity of refrigerant gas oil removed (plus approx. 20 cm^3 for the evaporator or plus 10 cm^3 for the condenser, rigid and flexible lines for refrigerant gas).
- Replace the butterfly (throttle).
- Assemble the refrigerant circuit.
- Remove any air and replenish the circuit ⇒ page 39 .

9.2 Replace the air conditioning compressor

9.2.1 Without any need to vent the refrigerant circuit with compressed air and nitrogen (for example, in case of external damage caused by an accident)

- Empty the refrigerant circuit ⇒ page 37 .
- Remove the air conditioning compressor and drain the oil from it ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .

Note

To speed up the outflow of the refrigerant gas oil, turn the compressor shaft manually using the pulley or the Air conditioning magnetic coupler - N25- .

WARNING

Use different refrigerant gas oils and filling volumes depending on the type of compressor used ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .

For example, 70 cm^3 of refrigerant gas oil have been removed from the damaged compressor and 220 cm^3 from the replacement compressor (a small amount of refrigerant gas oil remains in the compressor). In this case, fill the air conditioning compressor to be assembled with 70 cm^3 of refrigerant gas oil (the refrigerant gas oil of the replacement compressor may be used).

- Replace the butterfly (throttle).
- Assemble the refrigerant circuit.
- Remove any air and replenish the circuit ⇒ page 39 .

9.2.2 Leakage or internal damage (such as noises or lack of power)

- Empty the refrigerant circuit ⇒ page 37 .

- Replace the air conditioning compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .
- Replace the liquid/collection tank or dryer filter and the butterfly (throttle) ⇒ page 82 .
- Check the expansion valve and replace it in case of signs of impurities or corrosion.
- Assemble the refrigerant circuit
- Remove any air and replenish the circuit ⇒ page 39 .

9.3 Replace the liquid/collection tank and the butterfly (throttle)

The collection or liquid tanks need not be replaced in the following cases:

- After an accident in which the collection or liquid tanks have suffered no damage.
- When the repair is carried out within the normal repair time, without humidity absorption, and the vehicle is less than 5 years old.

Replace the collection/liquid tank in the following cases:

- When the refrigerant circuit is open and the vehicle is more than 5 years old.
- The refrigerant circuit has been open for an undetermined period of time (leak).
- Repair work has lasted longer than the normal time and humidity has been absorbed.
- As a rule, replace the collection or liquid tank after venting (cleaning) the refrigerant circuit, and keep it closed for as long as possible to minimize humidity absorption.
- The collection/liquid tank is damaged (accident).

The current liquid tanks (dryer) are assembled on the condenser and are equipped with a filter. Refer to the specific repair manual for each vehicle to replace the dryer filter ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning

9.3.1 After cleaning the refrigerant circuit or in case of impurities

- Empty the refrigerant circuit ⇒ page 37 .
- Remove the air conditioning compressor and drain the oil from it ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .
- Eliminate the cause of the fault.
- Check the expansion valve and replace it if it shows signs of impurities or corrosion.
- Remove the oil drainage screw of the air conditioning compressor.

Note

To speed up the outflow of the refrigerant gas oil, turn the compressor shaft manually using the pulley or the Air conditioning magnetic coupler - N25- .

– Fill the compressor with the specific oil amount recommended for each vehicle ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning

WARNING

Use different refrigerant gas oils and filling volumes depending on the type of compressor used ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioning .

– Replace the liquid/collection tank and the butterfly (throttle).
– Assemble the refrigerant circuit.
– Remove any air and replenish the circuit ⇒ page 39 .

9.3.2 No need to clean, no leaks and no penetration of humidity and impurities in the refrigerant circuit

– Empty the refrigerant circuit ⇒ page 37 .
– Replace the butterfly (throttle).
– Remove the liquid/collection tank.
– Clean impurities from the liquid/collection tank.
– Weigh the liquid/collection tank.

Note

Fill a new liquid/collection tank with refrigerant gas oil until its weight is equal to that of the removed tank.

– Install the liquid/collection tank.
– Assemble the refrigerant circuit.
– Remove any air and replenish the circuit ⇒ page 39 .

10 Test equipment and tools

10.1 List of test equipment, tools, and material

Note

- *This list is an overview of the equipment, tools, and material required for carrying out professional repairs in the refrigerant circuit.*
- *Other available test equipment and tools may also be used. Refer to the ⇒ Special Tools and Workshop Equipment Catalogue .*

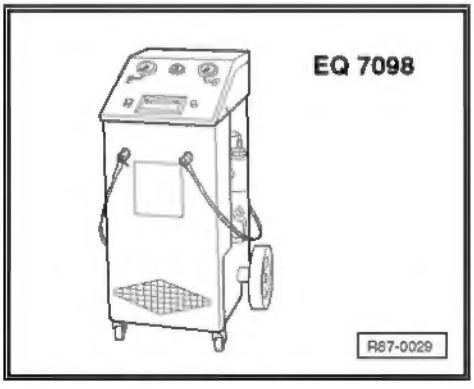
General overview	Page
Air conditioning unit recovery, recycling and refilling set or EQ 7098 - VAS 6008-	⇒ page 84
Climate control recovery, recycling, refilling, and cleaning set EQ 7104 ♦ With program for washing the circuit with R134a refrigerant gas.	⇒ page 85
Climate control recovery, recycling, refilling, and cleaning set EQ 7105 ♦ With program for washing the circuit with R134a refrigerant gas.	⇒ page 85
Climate control recovery, recycling, refilling, and cleaning set EQ 7110 ♦ With program for washing the circuit with R134a refrigerant gas.	⇒ page 85
Climate control recovery, recycling, refilling, and cleaning set EQ 7111 ♦ With program for washing the circuit with R134a refrigerant gas.	⇒ page 85
Climate control leak detector R134a or VAG 1796	⇒ page 86
Pressure gauges with nitrogen pressure regulator (maximum pressure: 15 bar) ♦ For detecting leaks in the refrigerant circuit by pressurizing the system.	⇒ page 86

10.2 Test equipment, tools, and material

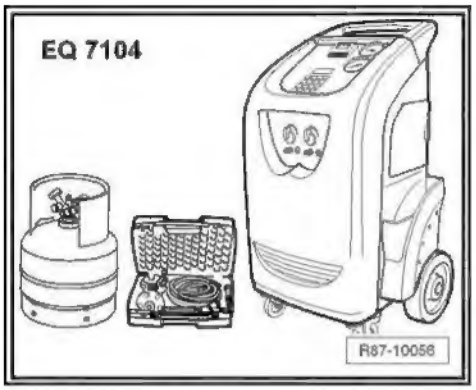
Note

Other available test equipment and tools may also be used. Refer to the ⇒ Special Tools and Workshop Equipment Catalogue .

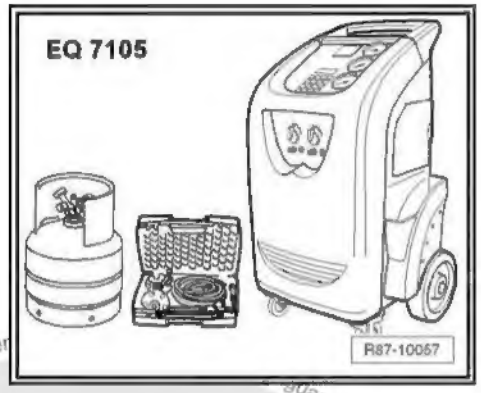
Air conditioning unit recovery, recycling and refilling set or EQ 7098 - VAS 6008-



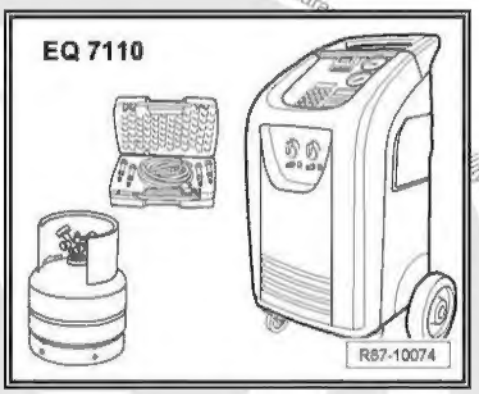
Air conditioning unit recovery, recycling, refilling and cleaning set - EQ 7104-



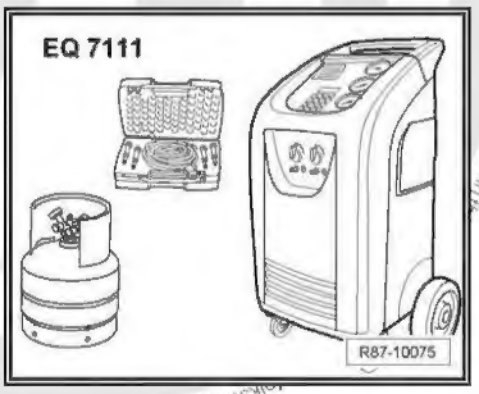
Air conditioning unit recovery, recycling, refilling and cleaning set - EQ 7105-



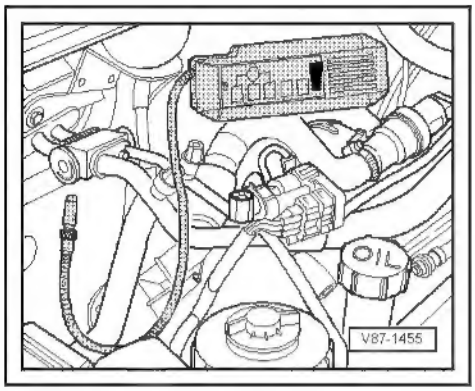
Air conditioning unit recovery, recycling, refilling and cleaning set - EQ 7110-



Air conditioning unit recovery, recycling, refilling and cleaning set - EQ 7111-



R134a air conditioner leak detector - VAG 1796-



Pressure gauges with nitrogen pressure regulator (maximum pressure: 15 bar)

1 - Pressure gauges with pressure regulator

2 - T Connection

3 - Flexible pressure line (inner diameter 5 mm, length 2 m)

4 - Nitrogen bottle